Among Our Writers

Walter L. Fitzgerald, before becoming manager of the Philadelphia Technical Service Committee, had had almost 30 years' experience in civil engineering work, including phases of personnel management. As head of this Philadelphia employment agency financed exclusively by local engineering organizations, Mr. Fitzgerald is in a position to give good advice on engineering employment matters.

A. J. Hammond, Past-President of the Society, has had wide experience in the design and construction of public works, including the $75,000,000 Chicago union railroad station. In private practice he has reported on the value of such undertakings as the union stations for Des Moines and Sioux City, and the vehicular tunnel under the Delaware River.

George W. Burpee has had over 30 years' experience in general engineering and construction work. For the past 16 years he has been connected with Coverdale and Colpitts, consulting engineers, concerned with the engineering aspects of business and financial undertakings. Since January 1924 he has been a member of the firm.

Donald H. Sawyer, recently Vice-President of the Society, has been in the federal service since 1931, serving consecutively as director of the Federal Employment Stabilization Board, temporary federal administrator of the Public Works Administration, and special assistant to the Director of Procurement.

William J. Fox holds a degree in civil engineering from the University of Southern California. Since 1926 he has been chief engineer of the Regional Planning Commission of Los Angeles County, and also, since 1933, chief engineer of the County's Department of Buildings, which he organized.

T. T. McCrosky has had a wide variety of experience, including teaching and city planning work. Previous to his recent appointment as regional project adviser for the U. S. Housing Authority, he served for 6 years as city planning director of the Planning Commission and acting executive officer of the Municipal Housing Authority of Yonkers, N.Y.

Joseph Nevin, previous to 1933, was engaged chiefly in mechanical engineering research, both in this country and in Cuba. Since that time he has been district manager of the New Jersey State Housing Authority in charge of activities in the northern part of the state.

Wilbur J. Watson holds an honorary D.Eng. degree from the Case School of Applied Science. He has maintained a private consulting practice for over 30 years and has also acted as designing and supervising engineer for Cleveland's bridges and buildings. He is the author of a number of books on bridge architecture.

John P. Hogan served overseas with distinction during the World War, rising to be lieutenant-colonel on the general staff. He has been connected with Parsons, Klapp, Brinckerhoff and Douglas since 1920, and a member of the firm since 1926. He has served both as Director and as Vice-President of the Society.

Ricardo L. Vásquez is general director of the Highway Department of Mexico.

Earl J. Reeder, who holds degrees of mechanical engineer and civil engineer from Michigan State College, has specialized for nearly 25 years in accident prevention and traffic engineering work. He is now chief traffic engineer of the National Safety Council, with which he has been connected for 13 years.

Ladislas Segoe taught civil engineering at the Technical University of Budapest before engaging in the design of city and regional plans in this country in 1921. Since 1928 he has been in private practice, principally in city planning and housing work, and is now planning consultant to the National Resources Committee.

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Something to Think About

A Series of Reflective Comments Sponsored by the Committee on Publications

Putting the Best Foot Forward

Practical Ideas on How an Unemployed Engineer May Gain a Sympathetic Hearing

By WALTER L. FITZGERALD
MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS

ALTHOUGH there may not be any one fixed "best way" of securing work, many of the factors that tend to help an applicant are widely recognized by anyone familiar with practical methods and results of interviewing prospective employers. Such an advantage has been given Mr. Fitzgerald who, after some years as manager of the Philadelphia Technical Service Committee, has a background of intimate study of this problem particularly as it relates to the difficulties of engineers. His suggestions would be of value for anyone unemployed, at any time; but just at present they have an added significance. He therefore offers some hints that he believes will find numerous and definite applications, especially at this critical time.

IN recent years the causes of unemployment among technical men have in most cases been beyond the control of the individual. And during this period, when few positions have been available, the technique of finding employment has undergone a complete change. Many men have of course already solved their problems, but there are many others who have not yet found the solution—who do not know, frankly and simply, how to apply for a position.

Danger of False Confidence.~Every man with a job naturally feels that he knows just how to go about getting another, but this concept rapidly changes when he finds himself looking for work. The shoe is then on the other foot and he becomes acutely aware of realities. Blind optimism then turns overnight to stark pessimism. Psychologically he drops way below par. Actually although unconsciously he is on the defensive. He calls on those who would seem to be the best prospects for utilizing his services; he consults friends; gets letters of introduction; and after trying every conceivable method and scheme finds himself back at his starting point, with the feeling that every condition and every circumstance is a stumbling block in the achievement of his purpose.

About this time economic affairs at home are becoming pressing; and as a result, just when a calm study of the whole situation is most vital, a man's thinking and talking are most likely to become stilted and impractical. He uses up reams of paper in preparing experience records; makes new lists of prospective employers; answers advertisements; and finally starts to broadcast circular letters. Eventually he begins to lose faith in his own ability.

No Stereotyped Method.~What is the answer? Is there any simple formula for getting a job?

After an experience of several years in the employment business, during which over 50,000 unemployed men have been interviewed and nearly 1,000 employers have been contacted repeatedly, presumably it should be possible to list accurately and in order of importance all the elements that have a bearing on the problem. But if there is one thing that such experience demonstrates, it is that a man should not be too definite or positive about what every other person should or should not do.

There is no formula, no book of rules, that will give unfailing results. Each man usually follows his own bent as to the method of approach. Probably it is better so, that he should stay in his own character, so to speak—he is never at his best when he tries to assume some other part. Further, it is highly desirable that he should appear as a novice rather than to be too clever in the art of job junting.

Primarily a Matter of Salesmanship.~Nevertheless, the art is not so complicated as it sometimes appears to be—many a man inadvertently creates, himself, the

complexities he encounters. Thus he is, unwittingly, his own "stymie." Some of the elements that loom large in his mind are really insignificant factors in the problem of finding a job. Let us then reduce the problem to its elementary terms.

Finding a position is a sales proposition in which the applicant must do two things: First, he must decide just what he has to sell; and second, he has to determine where he is going to try to sell it. This is a simple statement—so obvious, one may think, as to be trite. But what actually happens is that the great majority of job seekers reverse the order of the factors. They devote time and energy to working up appointments, only to find when face to face with their prospects that they have not given sufficient thought to their wares to make a proper presentation. Thus through lack of proper preparation, or qualifications, they "flunk" this all-important examination.

Where Salesmanship Is Needed.~It is reasonable to assume that any man in a position to hire has other tasks to perform and does not particularly enjoy taking time to interview applicants. He wants to find the right man with the least time and trouble. It follows that the successful applicant usually proves to be the one who is the best salesman—the man who can spread his wares on the counter quickest and most convincingly.

Yet most men are poor salesmen. Though they can visualize a large picture of their accomplishments in which every detail is clear and distinct, few are capable of conveying a concise word picture of it to a prospective employer in such a way that he is willing and anxious to hear about it. Recently a number of personnel managers and large employers were asked this question: "What is the matter with the approach and methods of men seeking positions?" Here are some of the answers:

Few men have a clear picture of their own abilities.

Some men must be pumped for half an hour to get at the information they should have given in thirty seconds.

Many an applicant places all the burden of finding out whether he is suited for the position on the man who is interviewing him.

The applicant himself makes the interview difficult.

The energy and real ability some men use in being stubborn and perverse about a frank and definite statement of their abilities is worthy of a better cause.

Possible to Over-Sell.~Men are justly afraid of missing an opportunity, and for fear that they will stress one thing only to find that they should have taken a different tack, they build up a most complicated form of presentation, which is so general and is spread so thin, that they become lost in a maze of their own building. The good points which might have been readily "sold" are brought up after the subject has turned cold, and sound like weak afterthoughts.

If then we must find a rule to follow, we can take the story of the boy, who on seeing a sign, "Boy Wanted," took down the sign, and laying it on the manager's desk, said, "Here's your sign, I'm the new boy." There is some risk involved in such a procedure, but the psychology has thousands of applications.

The Candidate's Attitude.~The employers' viewpoint might be illustrated by the story of the employer who, desiring to hire a man for a special position, wrote out a long specification of all the required qualities. On reviewing what he had written he tore it up and wrote: "What I really want is a man who *looks, acts,* and *talks* as if he knows where he is going." We may judge from this that specialized technical knowledge is only part of a man's qualifications for many positions.

A very prominent man was once asked how he was able to make so many correct decisions on so many large problems. His answer was: "I have one test to apply to every problem brought to me, viz., if it is complicated, there is something the matter with it." This problem of finding a position, though difficult, must not be permitted to become complicated. It is not so much a matter of methods, precepts, or schemes, but rather an attitude of mind coupled with a fair and reasonable appreciation of what the employer wants and how he reasons.

Some Elementary Rules.~Granted, there is much of "fortunate chance" in finding a position; but it is a slender reed on which to lean. The best preparation for the applicant is to be able to give a clear, brief, concise, definite statement of his abilities and then be versatile enough to take advantage of what we call "fortunate chance."

In all fairness to himself, he should put his best foot forward. In his interview there are a few things he should certainly do and others he should avoid—for instance, he should:

Be brief—leaving the impression he can support his statements with plenty of amplifying details.

Be neat—make the most of appearance; look prosperous.

Be prepared to supply a written record—not over a page, typewritten, for leisurely study—concise, leaving something to the imagination.

Be enthusiastic—show that his mind is alert, that he is master of himself as well as of his profession.

Be up-to-date—indicate familiarity with latest engineering progress, with recent publications.

Let others help—give ample references. This means that business and other friendships should always be kept in good repair.

Leave the door open—invite further inquiry, a later interview, or a more detailed record.

In short, appreciate the interviewer's viewpoint—try to realize what will appeal to him and stress such points; but, especially, study what features may irk him—and shun them.

A Good Starting Point.~But to be armed with these suggestions is not enough; in every interview the applicant must be quick to alter his tactics to fit the situation as it develops. And if there is one basic principle that will help him, it is this: Before attempting to answer the question, "What shall I do?" let him make sure that he can answer one other question, in whatever form it may be put: "What *can* you do?" This is the one and only starting point of the campaign.

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NUMBER 3

Federal Department of Public Works?

Discussing Its Background and Advantages, with Some Other Pertinent Facts

FEDERAL expenditures for public works more than doubled between 1920 and 1930, and in 1931, prior to organization of the emergency relief agencies, exceeded $400,000,000. In 1937 these expenditures doubled again, and if emergency work relief funds are added, reach the staggering sum of almost $3,000,000,000, or more than one-third the total expenditures of the federal government. When it is considered that not less than 100 different agencies administer these funds, it is easy to understand the demand for some form of centralization and simplification of activities such as would be afforded through creation of a Federal Department of Public Works. Three papers on this topic, presented during the general session at the Annual Meeting of the Society on January 19, 1938, are abstracted here.

In the opening article, Mr. Hammond traces the history of the movement for a Federal Department of Public Works from the first conference of engineering societies on the subject, held in 1885, to the recommendations and reports of government officials during the past year. The advantages to be expected from such a department, as outlined by Mr. Burpee, include logical development of an increasingly great problem, a simplification of the processes of carrying on the work, better control of funds and more direct responsibility for their application, improved economy, and development of better public service. In the concluding article, Mr. Sawyer urges the importance of a comprehensive study to assemble the data essential for promoting better administration of federal public works, and also calls attention to a number of significant facts.

History of the Movement

By A. J. HAMMOND
PAST-PRESIDENT AMERICAN SOCIETY OF CIVIL ENGINEERS
CONSULTING ENGINEER, CHICAGO, ILL.

THE Constitution of the United States, adopted nearly 150 years ago, did not refer to public works, and in Washington's cabinet there were five secretaries—State, Treasury, War, Law, and Post Office. The Navy Department was authorized in 1798; Interior in 1849; Agriculture in 1889. Commerce and Labor was authorized in 1903, but this department was separated into two in 1913. During the past sixty years there has been a movement for a separate Department of Public Works, becoming more articulate since 1919.

On December 3, 1885, delegates from 10 engineering societies held a meeting in Cleveland, Ohio, and formed a Council of Engineering Societies on Public Works. In March 1886, a second convention was held in Cleveland, with 23 societies represented.

In 1891 the late Clemens Herschel, Past-President and Hon. M. Am. Soc. C.E., then president of the Boston Society of Engineers, suggested in an address the idea of the engineer in public works, and again, in 1916, took up the same subject in his presidential address at the Am. Soc. C.E. Convention in Pittsburgh, where he urged the creation of a Department of Public Works because this field was not recognized in the Constitution.

That same year the late C. E. Grunsky, Past-President Am. Soc. C.E., gave a talk before the Inland Waterways Congress, in which he advocated a Federal Department of Public Works. Also, in 1916 the late Isham Randolph, M. AM. Soc. C.E., delivered an address before the Franklin Institute on "The Need of a National Department of Public Works," outlining the form of such legislation. During the same year he elaborated on the same subject in an address before the Engineers Society of Western Pennsylvania, giving a complete form of an act to accomplish the desired end.

Of special significance is a bit of legislation enacted in 1917 (referred to in the *American Year Book* for that year) which provided for a Federal Waterways Commission of seven members to be appointed by the President, at least one member to be from the active or retired list of the Corps of Engineers of the Army, at least one to be an expert hydraulic engineer from civil life, and the remaining five to be selected from either civil life or public service. The purpose of this commission was "to bring into coordination. . .the engineering, scientific and construction services, bureaus, boards and commissions of the several governmental departments of the United States, and commissions created by Congress that relate to the study, development, or control of waterways and resources and subjects related thereto, or to the development and regulation of interstate and foreign commerce. . . ." The personnel of the commission had not been announced by the end of the year and so this legislation evidently lapsed.

On April 23, 1919, a conference was held in the offices

Chicago Park District

AIRPLANE VIEW OF THE CHICAGO LAKE FRONT FROM JACKSON STREET (LEFT) TO WALTON PLACE, SHOWING THE OUTER DRIVE IMPROVEMENT, A PWA PROJECT

of the Western Society of Engineers, Chicago, which was quite extraordinary in that 81 representatives of 74 organizations having a total membership of 105,000, met for the purpose of considering the desirability of creating a Federal Department of Public Works. This conference was called by J. Parke Channing, chairman of Engineering Council. Twenty of the delegates were members of the American Society of Civil Engineers.

The main resolution adopted was prepared by a committee consisting of the late C. E. Grunsky, J. H. Herron, Baxter L. Brown, the late Peter Junkersfeld, Members Am. Soc. C.E.; and J. Parke Channing, I. K. Pond, F. K. Copeland, and W. O. Hotchkiss. It reads as follows:

"(*Resolved*)

"1. That the services and business of the national government, having to do chiefly with matters of engineering and architecture, be grouped in one department to be known as the Department of Public Works.

"2. That the Department of Public Works comprises those works which are built and operated for the use of the public.

"3. That the Department of Public Works be made available when desirable for the performance of special engineering and architectural work for the use of other government bureaus.

"4. That there be a systematic classification and organization of engineers, architects, and other employees whose status shall be such that they may be recruited and maintained on merit."

By reason of the interest aroused by this conference, Senator Jones of Washington in 1919 introduced S. 2232, "to create a Department of Public Works and define its powers." Congressman Reavis, of Nebraska, sponsored an identical bill, H. R. 6649. Senator Knox submitted Senate Resolution 393 to change the name of the Department of the Interior to the Department of Public Works, and Senator McCormick introduced S. 4452, "to bring more coordination of executive departments, create a Department of Public Works and Department of Public Welfare."

Herbert Hoover, Hon. M. Am. Soc. C.E., in his presidential address of August 26, 1920, before the American Institute of Mining and Metallurgical Engineers, said:

"The time has arrived in our national development when we must have a definite national program in the development of our great national problems. . . . We must create a national engineering sense of provision for the nation as a whole. . . ."

In 1921, the National Public Works Department Association urged the passage of the Jones-Reavis bills, S.2232 and H. R. 6649, to accomplish the following ends by combining the engineering and public-works functions of 9 federal departments, 35 bureaus, and 4 commissions under a single control:

1. To create an industrial organization out of many functions.
2. To secure increased efficiency by bringing under one head and dovetailing in a well-balanced machine, all works now built or operated.
3. To effect large economies and wise appraisal of plans, projects, and expenditures.
4. To eliminate rivalry and competition for all appropriations between departments and bureaus.
5. To provide a specialized organization to do technical work for other departments.
6. To standardize government contracts and specifications.
7. To simplify specifications for materials.
8. To provide complete business organization for peace or war.
9. To render efficient the budget system.
10. To serve as a regulator of our national industries to speed up in dull times and slow down in boom.
11. To provide means for officers of the Corps of Engineers to have a broader engineering experience.
12. To bring the United States in line with other important countries.
13. To provide for coordinating technical research.

Throughout 1921 and 1922 there was continual discussion of government reorganization, involving public works. In 1923, the Institute of Government Research recommended the conversion of the Department of the Interior into a Department of Public Works and Public Domain, listing the bureaus to be placed therein.

At the call of American Engineering Council, some 80 delegates, representing 60 separate engineering and allied organizations, met in Washington, D.C., on January 9, 1924, in a public-works conference to consider a movement for a Federal Department of Public Works. Secretary of Commerce Herbert Hoover, in addressing this meeting, said:

"The principal advantage of a Department of Public Works is that it would create a center of government construction policy, and, while the saving in personnel and efficiency would be increased by coordinating all engineering work under the government, I think the value

would be more in leadership for the great balance wheel of construction which lies in government construction work."

The conference adopted the following resolution:

"*Resolved*, That this conference of engineers and architects, and allied interests. . . endorses grouping and coördinating within an existing department, preferably renamed a Department of Public Works, the construction and administration of all non-military public works."

The Board of Direction of the American Society of Civil Engineers, at its meeting in January 1925, adopted a resolution reaffirming its former expressions of approval of the formation of a Department of Public Works.

During 1924, 1925, and 1926, a number of bills were introduced in Congress on the subject of reorganization, but the outstanding development during 1926 was the report in November to the administrative board of American Engineering Council, of a committee which had been working for months on the organization of public works, comprised of the following: E. O. Griffenhagan, J. L. Jacobs, the late Elwood Mead, and Sanford E. Thompson, Members Am. Soc. C.E.; and Wallace Clark, John Price Jackson, and W. F. Willoughby. The members of this committee had been selected with the utmost care and were eminently qualified for the task. The committee's study resulted in the most elaborately detailed report on the subject produced to that date, and perhaps since, and it is printed in full in the *Congressional Record*, 69th Congress, second session.

The text of this report is divided into three principal parts:

1. The first part sets forth the scope of a Department of Public Works and Domain. In this part units of the federal government involving functions related to public works are set up and their allocation indicated. The economies effected through consolidation and simplification were estimated at 5 per cent. On the basis of a billion-dollar annual expenditure, there would be, therefore, a saving of $50,000,000 a year.

2. In the second part is described the organization structure of a Department of Public Works and Domain. Under the secretary and directing engineer of public works, there was set up the organization structure, taking into consideration sound theory, tried practice, and feasibility, but not giving any conscious weight to elements of expediency.

3. The third part deals with the advantages of establishing a Department of Public Works. The arguments are:

a) The proposed change is in the interest of simplicity.

b) There is logic and common sense in the association of the various activities that will make up the work of the new department.

c) The new department makes it possible to reduce overhead costs.

Courtesy Chicago Aerial Survey Co.

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d) The new department will make possible the elimination of much duplication among the major departments and bureaus of the government.

e) The idea of the proposed plan, both in its general form and in its application to public works, has been independently developed in any number of studies of state organization and municipal organization as a way to greater administration efficiency.

f) The government will be able to bring about highly desirable employment conditions and opportunities for its technical personnel in the engineering, architectural, and related scientific services.

g) The concentration of construction work in one department will facilitate the planning of the financial program.

h) The economies possible in a department of the kind proposed, in the utilization of quarters and equipment, and in the use of supplies, are striking.

This whole matter was quite fully discussed in the hearings on H. R. 8124 in 1928.

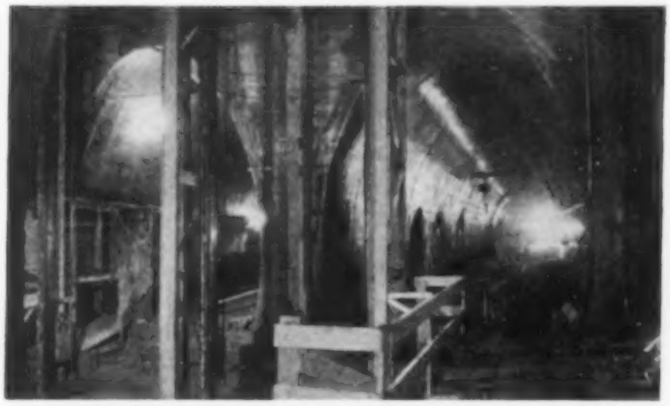
In the 72d Congress, April 1932, Senator Logan introduced S. 4462 to create an Administrator of Public Works, with five divisions and a director for each.

By executive order of President Hoover in December 1932, the title "Assistant Secretary of Interior" was proposed to be changed to "Assistant Secretary of Public Works," under whose authority there were to be listed 15 departments, bureaus, commissions, and so forth, all having to do with engineering, architecture, and construction

Alonzo J. Hammond

REINFORCED-CONCRETE THREE-SPAN ARCH BRIDGE AT SOUTH BEND, IND.

Designed by the Author as Engineer and Architect



DOUBLE-BARRELED INTERCEPTING SEWER FOR SOUTHWEST SEWAGE-TREATMENT WORKS

Each Barrel Is 13 Ft by 16 Ft 3 In., with a Capacity of 1,200 Cu Ft per Sec

of public works. This order was a part of a general reorganization plan proposed by President Hoover under authority of Congress, but when the order went to Congress for approval the House of Representatives alone took it upon itself to disapprove of the recommendations, and though it was afterward held that a single branch of Congress could not legally deny an executive order, yet the whole matter was dropped by a change of administration.

In connection with this executive order of President Hoover, I quote from a book entitled *America Go Bust*, by Louis Ludlow, a Democratic member of Congress from Indiana at the time:

"In the interest of efficient and economical administration, this consolidation should be made without delay. All of the construction activities of the United States and those relating to the maintenance of public works should be centered in a bureau or office of public works. One of the master engineers in this country should be placed at the head of that combined activity. . . . The economies that might be wrought by this sort of consolidation are incalculable."

In March 1936, President Roosevelt appointed a committee to investigate the executive branch of the government and problems of administrative management. In the President's message to Congress in January 1937, among other things, he recommended the creation of a Department of Public Works, and the report of his committee, consisting of Messrs. Brownlow, Gulick, and Merriam, became available. This committee recommends a separate Department of Public Works "to advise the President with regard to public works . . .to design, construct and maintain large-scale public works, which are not incidental to the normal work of other departments except as their agent on request; to administer federal grants, if any, to state and local governments, or other agencies for construction purposes, and to gather information with regard to public works standards throughout the nation."

At the request of the President, Congress set up a joint committee on government organization, which in turn created a select committee on investigation of executive agencies with Senator Harry Flood Byrd as chairman. This committee employed the Brookings Institution, and Report No. 14, on government activities in the field of public works and water resources, was prepared by that organization.

The principal recommendations of this institution are as follows:

"It is not considered advisable to establish a separate public works agency to undertake all engineering and construction work for the government. River improvement construction and operation might be entrusted to a separate engineering organization located in the same department as the Bureau of Reclamation. It appears desirable that the Corps of Engineers of the War Department should be relieved of its non-military responsibilities. The Public Buildings Branch of the Procurement Division should be transferred to the proposed new General Supply Service."

From a study of these two reports and a consideration of the personnel of the authors, it would appear that the more authoritative document from every angle is that of the President's committee, as these men have all been engaged in practical administration and management, and are equipped with all the fundamental theory of government as well.

The Board of Direction of the American Society of Civil Engineers, at its meeting in New York in January 1937, passed a resolution which was described in a letter to the President in the following terms:

"This Board approves, in principle, the formulation of a Federal Department of Public Works as proposed in the program of the President of the United States. The board was aware of your message to the Congress in which you proposed that all construction to be performed by the federal agencies, except that of the Corps of Engineers of the Army, should be under one administrative unit or Department of Public Works."

At its meeting in July 1937, the Board of Direction resolved "That American Engineering Council be requested to concern itself actively in the enactment of suitable legislation designed to create a Federal Department of Public Works, as proposed by the President of the United States, with a definite provision for excluding the Army Engineers and their river and harbor work from this department."

Resolutions favoring a Department of Public Works have been adopted during 1937 by the Engineering Societies of New England, Inc., the American Engineering Council, the American Association of Engineers, and others.

In February and March 1937, hearings before the

NEW U. S. POST OFFICE IN CHICAGO—A FEDERAL PUBLIC WORKS PROJECT

Joint Committee on Government Organization were held, having under consideration the message of the President transmitting the report of the President's Committee on Administrative Management in the Government of the United States, and also Report No. 14, prepared by the Brookings Institution, on government activities in the field of public works and water resources.

Verbal testimony only was permitted from the members of the President's committee and representatives of the Brookings Institution, so these two reports alone were featured.

Representatives of American Engineering Council asked to be heard but were told to submit their statement in writing, which was done through a comprehensive statement on August 16, 1937, prepared by Executive Secretary Frederick M. Feiker, addressed to Senator James F. Byrnes, chairman of the Select Committee on Government Reorganization.

The estimated average annual expenditure for construction in the United States from 1926 to 1933 was approximately $9,000,000,000, and in 1928 reached the enormous sum of $12,000,000,000. The second largest industry in the country in normal times—the construction industry—employs directly and indirectly some 5,000,000 men. The guiding and employment elements of the industry are the professions of engineering and architecture, together with general and special contractors

In recent years public-works improvements have grown by leaps and bounds and have dominated the construction field, so the reasonable conclusion is reached that the importance of this field is such as to fully justify representation in the government by a Cabinet officer. As I visualize him, this official will be a distinguished member of the engineering profession, just as the Attorney General is always a member of the legal profession. To obtain such a result there should be solidarity of opinion among all engineers who are interested in the advancement of the profession

Advantages of a Federal Department

By George W. Burpee

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Although the question of the establishment of a Federal Department of Public Works has been discussed so often in the past as practically to exhaust all lines of approach to the problem, yet no agreement has been reached on this or any other important matter relating to reorganization of the federal government.

The purpose of this paper is to present the advantages of the establishment of such a department. First, however, it is essential to define the purpose of this department, its nature, scope of activities, and functions.

PUBLIC WORKS DEPARTMENT DEFINED

The major purposes of such a department, to use with some minor changes the language of the President's Committee on Administrative Management in the Government of the United States, would be: To advise the President and Congress with regard to public works; to design, construct, and maintain large-scale public works which are not incidental to the normal work of other departments, except as their agent on request; to administer federal grants, if any, to state or local governments or other agencies for construction purposes; and to gather information with regard to public works standards throughout the nation.

As to whether this suggested Department of Public Works should be a "department" in the technical sense in which the term is used in the federal government—that is, an arm of the government headed by a secretary with a seat in the Cabinet—or whether it should be some other form of establishment in which the general architectural, engineering, and construction activities of the federal government are centered, is perhaps immaterial; but an establishment independent of existing major departments seems desirable in order that each one of these major departments may be able to deal with the new official body on an equal footing.

As I visualize the Department of Public Works, it would be a service organization designed to act as the tool of Congress and the executive department in carrying on the general engineering and construction activities incidental to the maintenance and development of the property and domain of the United States, performing such engineering projects as might be specifically authorized by Congress from time to time and assigned for execution, either directly to the Department or indirectly as the agent for another department. When acting in the latter capacity, the Department's relation to the government body immediately concerned would be that of an architect or an engineer to his client.

It is not contemplated that the Department would be a planning board or a policy-making agency except as to such matters specifically referred to it by Congress. However, with the passing years, the Department would accumulate, coordinate, and correlate a mass of information relating to the physical characteristics of the government property and domain which would be invaluable to a planning board.

It is not contemplated that the Department would assume engineering or construction so closely related to the functions of an existing major department as not to be readily separable therefrom. These departments would merely have at their command the services of the Department to supplement their own staffs should occasion require. It is not contemplated that the Department would take over engineering staffs of such agencies as the Reconstruction Finance Corporation, the Interstate Commerce Commission, or the Bureau of Mines.

Nor would the Department be a great government agency set up to compete with private architects, engineers, and contractors; on the contrary its staff would be supplemented on occasion by the services of private architects and engineers; and construction work would be done by contract wherever practicable and economical.

Public buildings, reclamation projects, highways, rivers, harbors, and flood control constitute the principal public works activities. Those now carried on by other departments, which would logically come within the scope of the Department are the Geological Survey; the Bureau of Reclamation, as to its engineering and construction functions (both now within the Department of the Interior); the Bureau of Public Roads (now in the Department of Agriculture); the Office of Supervising

Architect (now in the Treasury Department); the Coast and Geodetic Survey, as to primary control work (now in the Department of Commerce); the Office of Public Buildings and Public Parks of the District of Columbia; and the Architect of the Capitol (now independent agencies).

Hedrich-Blessing Studio

CLOSE-UP OF THE OUTER DRIVE BRIDGE, CHICAGO

Logically, the Department of Public Works should take over the work on rivers and harbors and on flood control and flood prevention now performed by the Corps of Engineers of the Army, but the practicability of such inclusion is by no means certain in the light of past experience.

The Department might also participate in supervision of the Works Progress Administration projects and in investigations for the Public Works Administration. But since these matters are fundamentally of a social rather than of an engineering nature, it might be desirable, on the other hand, to retain them in a totally separate agency.

Considering now the advantages or disadvantages of carrying on federal public-works activities through such a Department, the question is simply whether or not the Department will conduct its operations more advantageously to the public than do the various existing departments, bureaus, and independent establishments. As engineers, we should approach this problem from an objective and scientific point of view.

COMPLEX PROBLEMS COULD BE HANDLED

The first advantage of such a department would be the provision of a central organization adequate to cope with a great and complex problem of national importance. Although not a primary function of government, construction activities constitute now, and have constituted for many years, one of the federal government's major undertakings. Federal expenditures for public works more than doubled between 1920 and 1930 and indications are for continued growth. The outlook for the future accentuates the necessity for conducting such work on more effective lines.

For the fiscal year ending June 30, 1937, total expenditures of the United States, exclusive of debt retirement as reported by the Treasury Department, were in round numbers $8,001,000,000. Of this amount, the expenditures assigned to public works in the report of the Treasury Department was $1,079,000,000. Eliminating $362,000,000, which represents grants to public bodies, there remains $806,000,000 to which should be added $1,896,700,000 for work relief (including the Works Progress Administration and the Civil Works Administration), making an expenditure for all public works of $2,976,000,000, or substantially more than one-third of the total expenditures for the year.

In 1931, prior to the organization of the emergency relief agencies, the total federal expenditures, exclusive of debt retirement, were $3,671,000,000. During that year, expenditures for public works amounted to $404,000,000, or 11 per cent of the total expenditures.

The magnitude of the problem in terms of the expenditures involved is evident. An adequate conception of the extent of these activities is not possible as long as they are distributed among so many different departments and agencies, and even the highest degree of cooperation between departments cannot overcome the handicap of the lack of a central authority and of a national point of view.

THE DEPARTMENT WOULD SIMPLIFY PROCEDURE

A further major advantage which the Department of Public Works would offer would be simplified handling of engineering and construction work. Projects would be authorized by Congress, and then, after the necessary appropriations had been duly noted in the budget, would be entrusted to the Department for execution either directly or in collaboration with some other department.

It may not be generally realized that there are 133 establishments in the federal government, including departments, boards, commissions, authorities, corporations, and congressional and independent establishments, but not counting bureaus within departments. Although the number having jurisdiction over engineering matters is much smaller, it involves 5 of the 10 major departments and several independent establishments.

The engineering operations carried on under the jurisdiction of some of the departments are not connected with their normal functions. In other cases, the department having jurisdiction is the one which normally would be the policy-forming body.

The Departments of Agriculture, Commerce, the Interior, the Treasury, War (in the event that work of rivers and harbors and flood control were to be transferred from that department), and other independent commissions would be relieved of the design and execution of undertakings entirely or largely alien to their work, and the chiefs of these departments would then be left free to concentrate on their primary functions. Provision would be made, as previously stated, for close cooperation between the Department of Public Works and the other departments. The functions of existing departments would be simplified by the elimination of alien activities; the conduct of public works would be simplified by centralizing the operations incident thereto.

The manner in which general engineering activities are scattered through the major departments and the number of employees engaged in such work in each department is shown in Table I, prepared by my associate, Frederick A. Davidson, Assoc. M. Am. Soc. C.E., from an analysis of the 1938 budget.

BETTER CONTROL OVER EXPENDITURES AND GREATER ECONOMY

The Department would have the further advantage of ensuring a closer control over expenditures than is now possible. This would be accomplished through direct budgeting to the Department for each project and the

strict accountability of one agency for performance within the appropriation. The budget would show the citizen directly the amount of expenditures for public works and eliminate the present necessity of research

Table I. Personnel Considered as Engaged in Public Works Projects

Abstracted from the U. S. Budget for the Fiscal Year 1938

Department or Agency	All Employees		Engineers, Professional and Subprofessional	
	Departmental	Field	Departmental	Field
TVA	...	5,109	...	Not Shown
Veterans Administration	Not Shown			
Department of Agriculture: Bureau of Highways	545	2,007	162	371
Department of Commerce	Not Segregated			
Department of Interior:				
Bureau of Reclamation	96	2,621	22	1,789
National Park Service	57	4,609	22	53
Bureau of Indian Affairs	19	640	14	203
Geological Survey (mapping and water resources functions only)	141	468	101	426
Subtotal, Dept. of Interior	[313]	[8,338]	[159]	[2,471]
Department of State	...	290	...	188
Treasury Department: Procurement Division, Public Buildings Branch	604	1,761	388	373
War Department	279	20,593	27	7,345
Total	1,784	39,298	736	11,755
Grand Total	41,086		12,491*	

* Not including TVA or territorial or insular possessions.

into the details of the budget in order to ascertain the extent of such expenditures.

The significance of this is shown by a study of Table II, also prepared by Mr. Davidson from the 1938 budget, giving the expenditures listed in the budget as "General Public Works Program" and the total amounts budgeted for general public works. This tabulation does not cover all items of engineering and construction work which would be considered as regular functions of the specific departments, but only those which might properly be considered for transfer to a Public Works Department.

Table II. Budgeted Expenditures for Public Works

As Drawn from the Budget Report for the Year Ending June 30, 1938

Department or Agency	Expenditures Classified Under the General Public Works Program	Total Budgeted Expenditures for Public Works*
TVA	$ 49,000,000	$ 45,865,494
Veterans Administration	10,000,000	10,000,000
Department of Agriculture	152,900,000	290,319,000
Department of Commerce	1,000,000	1,090,000
Department of Interior	58,052,000	90,380,500
Department of Justice	600,000	810,000
Department of State	4,250,000	4,400,000
Treasury Department	45,307,000	62,102,000
War Department	130,000,000	179,462,000
Architect of Capitol	....	4,506,000
Totals	$451,109,000	$688,935,000

* Including those in the general program and those of the same general nature, but not so reported.

The Department would have the further advantage of economy, both in cost of administration and in execution, resulting from simplification of procedure; closer control; pooling of personnel to secure the best talent for assignment to any undertaking; uniformity of procedure; methods of mass production; elimination of duplication of effort in administration, design, construction, and accounting; and timing of undertakings, wherever possible, so as to avoid a peak demand in the services of the staff.

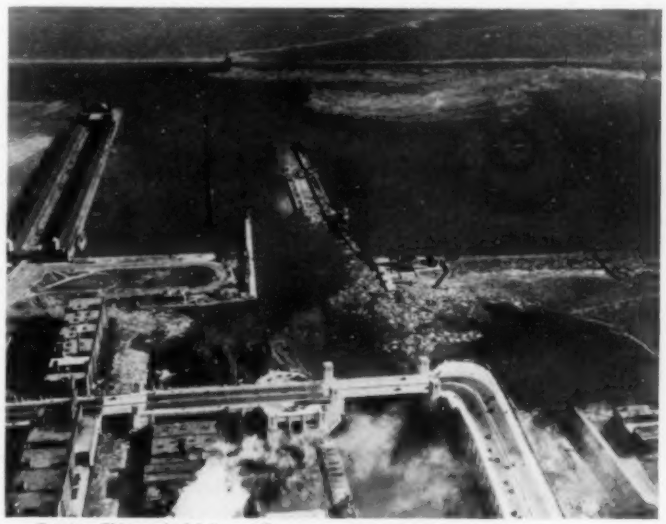
I should like to present a chart showing the functions of the different branches now engaged in works of this type and the personnel employed thereon in comparison with the personnel and payroll under the suggested régime, but unfortunately the data required for such a chart are not available, at least in published form. However, experience in engineering and business organization supports the conclusion that the transfer of activities from many compartments to which they are not directly related, to one compartment to which they are all related, will undoubtedly eliminate duplication and tend towards greater economy.

The Department would present the great advantage of becoming a clearing house for the various departments dealing with the property and resources of the United States. Its value in this sense would increase year by year and would become inestimable to Congress and the executive department in determining long-range policies for the country's development. Anyone who has had occasion to search for such information in Washington will understand the advantage of being able to direct his inquiry to one source. It is safe to say that under existing methods a great deal of valuable information is lost because of the searcher's lack of knowledge as to where such information may be found.

A Department of Public Works would develop, under the Civil Service, an engineering personnel able to serve the government in times of emergency as well as in normal times, in view of the many great opportunities offered ambitious young engineers for a career in government service. The creation of such an engineering organization is all the more important because the number of public works projects to be undertaken in the future will undoubtedly be greater than in the past.

PUBLIC WORKS PRACTICE OF VARIOUS STATES AND FOREIGN GOVERNMENTS

The practice of the states has generally followed that here suggested for the federal government. The states of Alabama, California, Connecticut, Idaho, Illinois, Massachusetts, New York, Ohio, Rhode Island, Tennessee, Vermont, and Washington have public works



Courtesy Chicago Aerial Survey Co.

Municipal Pier, Breakwaters, and New Controlling Works to Prevent the Chicago River from Flowing Into Lake Michigan

Outer Drive Bridge and Approaches in the Foreground

departments; most of the rest have highway departments, representing the major activity in public works.

To cite only two cases, New York's Public Works Department, under the direction of a superintendent of public works, includes canals and waterways and the divisions of highways, architecture, engineering, and public buildings. Its expenditures range from $50,000,000 to over $100,000,000 a year. The Department of Public Works of California, operating under a director, includes the divisions of the San Francisco–Oakland Bay Bridge, water resources, architecture, contracts and rights of way, and ports. Its expenditures are at the rate of about $50,000,000 a year.

Courtesy Chicago Aerial Survey Co.

AIRPLANE VIEW OF LOCK AND DAM AT STARVED ROCK ON THE ILLINOIS RIVER WATERWAY

Foreign governments have apparently found it advantageous to carry out design and construction under departments of public works. For example, in the Dominion of Canada the public works department is under a Minister of Public Works; in the Argentine Republic, Brazil, Chile, and the Republic of Peru, under cabinet officers; in Australia, under a cabinet officer; in Great Britain, buildings under the commissioners of works and public buildings (the first commissioner being a member of the government, frequently with a seat in the cabinet), and rivers and harbors under the board of trade appointed from the lords of the Privy Council; in New Zealand, Denmark, France, Italy, and Norway, under a cabinet minister.

Practically all the studies which have been made for reorganization of the federal government within recent years have recommended a Department of Public Works, except that of the Brookings Institution. This latter study suggests certain regroupings, generally along the lines of promotional and major functional activities. The Brookings Institution states that the work of the government engineers is too highly specialized to render a pooling of the activities economical, and that the benefits realizable through a Department of Public Works can be equally well secured by cooperation between departments, but these reasons seem to me to arise from a misconception of the degree of specialization involved.

SUMMARY OF ADVANTAGES

To summarize, the advantages of the establishment of a Department of Public Works are as follows:

Such a department is a logical development. Without it, the development of a logical program in regard to public works is impossible on account of the magnitude of the problem.

The Department will simplify present processes of carrying on such works and also the work of the major departments, which will then be free to concentrate on their specific purposes.

It will ensure better control by the allocation of funds for construction and the responsibility for accounting therefor to one department. This control will be further enhanced by the possibility of setting up the federal budget so that public works items will appear in such form as to be readily recognizable by Congress, the executive department, and the general public.

It will tend to improve economy by reducing overhead expense, eliminating duplication of effort, pooling of personnel, and standardization of processes (wherever practicable); and further, by reducing costs of construction through uniform specifications, contracts, and procedure.

It will tend to develop within the Civil Service a group of men making a career of the public service and acquiring a national viewpoint in the execution of public works projects; and, in time, will amass and classify information affecting the physical property and resources of the United States so as to be of inestimable value to Congress, the President, and all allied departments of the government in formulating policies for the development of the country.

Some Factors Bearing on the Proposal

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FOR a number of years I have been very much interested in some better form of administering public works of the U. S. Government and believe today that some improved and sensible program should be supported by the engineers of the country.

There appear to be four schools of thought with reference to the creation of a Federal Department of Public Works:

1. Some believe that all agencies whose functions make them eligible for inclusion should be gathered into such a new department—the ideal in their opinion.

2. Others, who take into consideration such practical matters as resistance to a complete regrouping in the beginning, and the chaos that might result from such a fundamental and violent shift, believe that something less than perfection should be the first approach—an alternative.

3. Still others prefer an expansion through the long-established policy of having agencies peculiarly fitted and experienced in design, construction, and maintenance function for other agencies requiring such services—an adherence to demonstrated procedure, but providing for

the concentration of smaller agencies into larger existing permanent ones of like nature until such time as these augmented units might be merged in a new department.

4. Some favor no change in the federal structure at this time—laissez faire.

Most of the resolutions passed by engineering bodies in support of the formation of a Department of Public Works adhere to the first view, that of complete reorganization in the original effort.

The Society has always I think viewed with favor a unifying of the federal agencies that concern themselves with the engineering profession. Many official actions, the testimony of its representatives, its literature, expressions by its subsidiary bodies, and other evidences indicate this conviction.

Importance of Comprehensive Study

But its recommendations have been founded more on wishful thinking than on comprehensive analysis. The question of the formation of a Department of Public Works is of such great significance that it deserves the same treatment that the engineer normally applies to his own field of operation. The Society, which has always tried to be careful in its pronouncements, can exercise a very helpful influence on this movement, but its studies and recommendations should be based on factual data. The material that should be explored is readily available; the Society possesses students of the proposal who have great organizing ability; and it is ideally equipped, if it will make use of its mental and factual resources, to advocate sound formulas of procedure. It would greatly strengthen its prestige if it collaborated with other bodies of like intent to the end that the technical profession may present a solid front.

If such a method is followed, certain factors should be taken into account. As an approach to the problem, it is desirable to dissociate functions from names of existing agencies and prepare a routine for analysis and judgment which will later facilitate the consideration of individual establishments for inclusion.

It is well to sketch an organization pattern for the contemplated new department in the beginning, as a guide to thought. Too much credence should not be given to the conclusions of former debates on this subject, as the complexions of the public-works agencies have undergone many changes in recent years.

As an illustration, years ago the expectation was to form a department that restricted itself to public works, whereas today the executive recommends that all duties of government be vested in the ten present departments and the two to be formed. If the latter plan be followed, the Department of Public Works might be expected to be more comprehensive in its scope than was contemplated in the past.

Several reports and proposals are now before Congress. All of these have originated since January 1, 1936. They are:

- "Report of the President's Committee on Administrative Management in the Government of the United States," recommending the formation of a new department to be known as the Department of Public Works
- A message from the President forwarding this report to Congress and endorsing the program
- Reports from the Brookings Institution on reorganizing the federal establishment
- Bills introduced into the Senate and House providing for certain forms of reorganization, but not for the creation of a Department of Public Works

Definition and Scope of Department

Immediately there arises the question, "What is meant by federal public works?" A definition of these might embrace the design and construction of all physical improvements financed by federal funds, and this is probably what most engineers have in mind.

But associated with these are many other powers closely related, allied, or playing a part in public works, and to simplify administration, it may be desirable to assemble the latter in some form of regrouping.

For a general view of the subject, a few brief statements and a number of figures will be of interest. Over 60 federal agencies have custody of land and improvements, and about 100 agencies have functions that entitle them to consideration for inclusion in whole or in part in a Department of Public Works. These are located in every one of the ten Cabinet departments and in numerous independent establishments. Some agencies have a single project; others have hundreds and thousands, situated in most or all of the states. The total of these projects is about 11,000. The federal real estate in the custody of these agencies extends from a few acres or square feet of urban or rural land to tracts of over 100,000,000 acres. The annual expenditures on these tracts vary from a few thousands to hundreds of millions of dollars.

Expenditures for public works have ranged from a quarter of a billion dollars a decade ago to two or three billions during the depression. Both engineering and architectural types of design and construction are engaged in by many agencies, and the character of the structures dealt with varies from extremely simple ones to very complicated ones.

It should be evident from the foregoing that the engineer should not jump at conclusions in approaching a solution of this problem, but should rather pick to pieces, study, analyze, and appropriate for his use all possible findings in order that what he may recommend will stand up under debate and criticism.

If this policy is adopted, his early enthusiasm for bettering the situation probably will not falter, whereas it is

Administration Building, Fredericksburg–Spotsylvania County National Military Park

certain that his findings will then bear examination, be more satisfactory to himself and his fellows, and warrant the desire of the Administration to improve on governmental organization. To do less than this is to withhold from those concerned with the problem the best judgment of engineers, whose talents permit them to speak with authority.

Todd Photo, Courtesy National Park Service

TRIANGLE GROUP OF GOVERNMENT ADMINISTRATIVE BUILDINGS, WASHINGTON, D.C.
Housing Departments of Commerce, Labor, and Justice, Post Office Department, Interstate Commerce Commission, Bureau of Internal Revenue, Federal Trade Commission, the Archives, and Independent Agencies

SOME GENERAL PRINCIPLES TO BE OBSERVED

As the engineer continues his examination of the subject, certain aspects will present themselves to him. For example, many engineers imagine that most of the units that are candidates for a Department of Public Works have construction as their sole operation, whereas the fact is that all such agencies have trusts which are foreign to a strict interpretation of public works, even though construction programs may dominate their activities. Thus, absorbing an entire unit does not merely involve picking it up and depositing it elsewhere—prudence demands examination of the details.

A larger group have public-works functions in varying proportions to their other duties. This category is complicated by many perplexing and significant factors. In few if any instances would this class of agency be selected for absorption. Rather, their construction or related duties might be serviced by the new department. There is nothing novel or untried in this, as many agencies execute design and construction for others. It will be found, however, that there are many border-line cases which appear when the problem is reviewed.

There is no point in establishing a Department of Public Works if its operations are more costly than the methods in use at present. However, the formulation of recommendations should do more than merely promise economy—they should establish, in a manner readily understood by others, the fact that savings will be effected.

Similarly, there is no point in combination if the efficiency of management will be less than exists today. The objective should be to formulate a policy which will so strikingly provide greater efficiency as to be satisfying to others. Also, the speed of the new department's processes must be not less than that of the present agencies.

In an examination of the problem as a whole, the maintenance and repair of improvements stands out as worthy of serious attention. Will this work become a part of the new department? The money involved and the details of administering it loom large with many, and the absorption of these by a single organization involves a continuing activity often consequent upon the original construction.

After a project has been completed, personnel and supplies are needed to operate it. Any resulting improvement must be watched, and again the question may be propounded, "Shall custodial operation be allocated to the new department?"

To the engineer not familiar with federal routine, it may be helpful to itemize the customary steps from the time an agency decides to provide a facility until that facility is ready for occupancy or use: (1) Decision by an agency and recommendation to its department, (2) consideration and recommendations by the department, (3) hearings before and recommendation of the budget, (4) hearings and appropriation by Congress, (5) selection and purchase of site, (6) design, (7) construction, (8) occupancy or use, (9) maintenance and repairs, and (10) custodial operation.

Design and construction each consist of two broad classes of work—one of engineering and the other of architectural conception. To the layman these may be similar, but to the technical mind they are very different. It is difficult to draw a fine distinction between them, and it must be recognized that in numerous instances engineers and architects collaborate.

Broadly speaking, engineering projects are generally in rural areas or underground, use raw or semi-fabricated materials, and employ common labor in large part. Architectural projects are largely in the cities, use finished materials, and employ skilled workmen. It has been said that engineering construction is horizontal and architectural is vertical, but many exceptions can be noted to the application of this latter classification.

CATEGORIES OF INDIVIDUAL AGENCIES CONSIDERED FOR INCLUSION

The federal agencies which may be candidates for inclusion in whole or in part in a Department of Public Works do not readily fall into definite categories, but for the purpose of this discussion some classifications are helpful.

There are a large number of agencies which expend relatively small sums on public works. Generally the type of construction is simple, and the sites are in isolated localities, frequently far apart. This may well be taken into account in considering whether or not they should be absorbed or their public-works functions serviced by a Department of Public Works. It is believed that

agencies in this category should be studied with care, since betterments of a nature important to the administering agency may well be of less moment to the larger one which has many vastly greater projects to carry on.

Another group is engaged in permanent activities of large scope. Most of these agencies have been going concerns for many years. They handle annually an immense number of enterprises and expend large sums for construction, maintenance, repair, preservation, and custodianship. These merit careful investigation.

Another group is composed of agencies which devote themselves solely to design and construction for national defense. These are large units with functions interwoven with others looking to the protection of the country. Judgment must be displayed in analyzing them, to the end that no interposition may affect their administration in times of emergency.

A number of agencies have custody of land with minor public-works features. It is often difficult to dissociate land from improvements fixed upon it, and in such cases the agencies must be analyzed individually to determine whether their functions of administration are sufficiently allied to public works to warrant their consideration for unification.

The government includes a number of surveying, mapping, and scientific branches which play a part in public works, and here again intelligent study is desirable to discover whether their inclusion would be justified.

In the departments and independent offices that do not have custody of land or engage in design or construction, there are nevertheless regulatory and planning functions which are influencing factors in public works. Whether or not these should be combined in whole or in part can be determined only after a detailed study of their duties, and of the probable effect resulting from their inclusion.

It has been a fixed practice for many years for certain federal agencies to perform technical, construction, and maintenance services for others. What is the merit and what should be the trend in such cases?

Examination of a list of federal agencies will show that many devote themselves to the extension of credit to individuals and corporations that use such funds for construction. Some of these are permanent, while others are temporary. In case of defaults, many find themselves in possession of land and improvements. Whether or not these should be included in the new department can only be determined by close study.

A number of temporary agencies are engaged in construction. These have largely been formed as emergencies have arisen. Some have disappeared when their legal life was ended, but others have been continued. Many are of great significance, and whether these should be taken over in whole or in part by a permanent agency is a question requiring extremely sound thinking.

Years ago human necessity was assuaged by direct outlays or payments for food, rent, and the like. Latterly, relief clients have been given employment on public improvements, the wages earned taking the place of the funds advanced for the support of the individual and his family. These types of improvements loom large in the picture. Do they fall within a definition of public works?

Some units design and erect undertakings of a highly specialized or monumental character which find little parallel in government or civilian offices. Should such types be transferred to a new group?

The United States has land and improvements in many foreign countries which also call for investigation.

Administration Building for the Guilford Courthouse National Military Park, Greensboro, N.C., a Federal Public Works Project

There are other agencies of large size devoted to the production of power, flood control, and navigation of streams. Their functions relate to original construction as well as to operation. Careful consideration should be given to the agencies in this category to decide whether their inclusion is warranted, and to fix their status in it if it is deemed prudent to include them.

What has been said heretofore relates to land and fixed structures, but it may be that those making this study will also desire to consider that vessels and floating equipment are so closely allied to construction as to be at least eligible for inclusion in the new department. Agencies building or having custody of vessels are numerous in the federal structure.

This classification is a rough one, but if the suggested study is properly conducted, it should apply a process of elimination to reduce the number of agencies, functions, and activities to be considered and to permit a greater concentration among those that remain.

Reviewing the Situation

Although no attempt has been made to minimize the complexities of the problem nor to go into detail, it is hoped that this paper has brought out some of the factors involved whose study may encourage sound reasoning and a program of action simplifying the organization of the government and resulting in something better than the present set-up.

Some engineers may conclude that the job is too big, too complicated, and too remote from their field for them to undertake it. Others, interested in public service, accustomed to difficult assignments, and keen for trying something that may lead to a higher form of administration than is now enjoyed, will argue that the challenge should be accepted.

The Society has considered this problem in a general way over an extended period, and has put itself on record in the matter. In the atmosphere of an administration friendly to its convictions, it should associate with others having a like objective and prepare to support its point of view with substantial evidence.

Air and Industrial Sanitation

Important New Fields for the Sanitary Engineer Discussed at Annual Meeting

ALMOST limitless possibilities for the sanitary engineer can be envisioned in the broad new fields of air sanitation and industrial sanitation. Smoke-abatement, air-conditioning, and the correction of chemical, biological, and physical health hazards in industry, are all included. And under each of these general heads comes a broad variety of fascinating problems, which demand far more than a nodding acquaintance with physiology and chemistry and many another subject outside the realm of "pure engineering" training.

At the Annual Meeting, an entire session of the Sanitary Engineering Division was devoted to papers and discussions on the subject. The brief summaries given here can touch only the high spots; however, it may prove feasible to give a more complete presentation of the two formal papers in a forthcoming issue of "Proceedings."

Aspects of Air Sanitation

A GENERAL survey of the field of air sanitation was presented by Earle B. Phelps, professor of sanitary science at the College of Physicians and Surgeons, Columbia University, New York, N.Y. "Air sanitation," he said, "may be taken to deal with the control of man's atmospheric environment, for the purpose of meeting the essential physiological requirements and of avoiding abnormal and harmful conditions. Such a definition automatically places it within the field of public health engineering."

Professor Phelps remarked that the ventilating engineer has long shown his ability to modify air to meet any specific requirements, but pointed out that the requirements themselves must be established through biological investigations.

As for out-of-door environment, our only significant modification thus far seems to have been to pollute it with smoke, dust, and gases. The extent and harmful result of such pollution has long been a matter of investigation and study. For example, over a considerable area on Staten Island it has been found that the concentration of sulfur dioxide is high enough to cause not only throat irritations but definite damage to garden crops. The Mellon Institute studies show that smoke interferes to a great extent with solar radiation; and of course in so far as the work of normal sunshine as a natural disinfectant is interfered with, smokiness is harmful. As for stimulating interest in the control of air pollution, "it must be freely admitted that economic arguments have thus far been more powerful than hygienic ones." It is interesting to note, however, that pollen counts in New York City have been used for the last two years to direct the work of eradicating ragweed.

Within doors, air sanitation is much more clearly defined. However, any effective control of the indoor atmospheric environment must first satisfy the requirements of human physiology—and from the standpoint of the physiologist the problem of removing excess heat from a human body is highly complex. Temperature, humidity, and movement must be taken into account; and to these must be added an important feature not at all related to the physical properties of the air itself—the temperature of the enclosing walls. A fine adjustment of each of these factors is more desirable than a hit-or-miss over-all balance, and these adjustments are an important subject of present-day research.

The problem has been approached largely from the empirical side, and the criterion of "comfort" has been generally employed. But in some cases more fundamental criteria have been investigated, such as incidence of respiratory disease, working efficiency, and so forth. "The distinction is important. Comfort is largely a matter of adaptation. We in this country are undoubtedly adapted to an unhygienic indoor temperature, as our foreign visitors never fail to point out."

An entirely distinct phase of air sanitation—that of air-borne infection—has been brought to our attention with new emphasis as a result of studies in the last four years. For example, it has been found that microscopic organisms sprayed into the air in the basement of a three-story building appear later in the top floor; that influenza virus sprayed into a test chamber remains suspended and viable for at least an hour; and that the number of alpha streptococci in the air in various places corresponds to the degree of contamination by the occupants. The possibilities of aerial infection over a considerable area and over a length of time is thus manifest. Sterilization of air by ultra-violet light is effective, and its feasibility on a working scale has been demonstrated.

"We are beginning," said Professor Phelps, "to accumulate data for a bacterial measure of air pollution and of ventilation and air-cleansing efficiency."

Air sanitation in industry presents so many problems that it actually constitutes a distinct field of study. Generally, however, the problems are of the same nature as those of normal air-conditioning—but on an exaggerated scale, dealing with extremes of heat, humidity, cold, dustiness, and chemical pollution. Many of these conditions are inherent and unavoidable; others can be remedied only at great cost; but still others are susceptible of economical correction. For example, the dust of rock excavation can be avoided by a variety of methods. Again, the toxic vapors and gases arising from various chemical operations can be rendered comparatively harmless by proper ventilation. However, before the problem is ready for the ventilation engineer, the physical properties of the gases must be investigated and data must be secured on "tolerance" and "permissible concentrations."

Vehicular tunnels present a unique situation. In the case of the Holland tube extensive studies were made of human tolerance to carbon monoxide and of the average rate of production of that gas by various types of motor vehicles. These studies determined the necessary rate of air supply and exhaust, and preceded the study of the actual ventilation problem itself.

"From this survey," said Professor Phelps, "it is evident that a field of knowledge and of administrative control is here outlined which is much broader than that customarily included within civil engineering. But this is not a novel situation; the design and operation of a water or a sewage-treatment plant, the control of mosquitoes, and many similar projects engage engineering ability and utilize engineering knowledge to accom-

plish certain purposes that are expressed only in terms of biology and chemistry. It is believed that the public health engineer must be prepared, with the necessary collaboration from the associated sciences, to assume ultimate responsibility and control in all such cases."

The Engineer in Industrial Sanitation

Problems in industrial sanitation were discussed by J. J. Bloomfield, Passed Assistant Sanitary Engineer, U. S. Public Health Service. These problems, said Mr. Bloomfield, constitute one of the most important phases of industrial hygiene, and come within the province of the engineer.

Industrial health hazards are classified into three types—chemical, biological, and physical. Under chemical hazards the most important are the so-called poisons; some 94 groups of such poisons, associated with approximately 2,500 occupations, have been listed by researchers. Biological health hazards include such infections as anthrax, tuberculosis, typhoid fever, and respiratory and venereal diseases. Physical health hazards embrace dusts that may cause fibrosis of the lungs, accidents caused by machinery and other environmental conditions, excessive humidity, heat and cold, and abnormal atmospheric pressure.

It is the physician's task to recognize the existence of those diseases associated with the working environment; but it is the engineer's function to study the working conditions that may be detrimental to health, and by precise quantitative measurements determine the extent of the hazard. Once this has been determined, it is also the engineer's problem to evolve methods for controlling the hazardous conditions; and, finally, to study the effectiveness of the methods he has prescribed and installed.

Engineering studies of the working environment involve the determination of the occupational exposure to such air-borne materials as dusts, vapors, fumes, mists, and gases, and to substances that may cause corrosive burns or dermatoses. Studies of the physiology and mechanics of ventilation, illumination, and exposure to extreme conditions of temperature, humidity, noise, and fatigue, also come in the list. To have a broad perspective of the problem, the engineer should be at least familiar with the toxicology of many of the materials employed in industry, and should have some knowledge of industrial legislation and labor economics in general.

For a specific example of a problem in industrial sanitation, Mr. Bloomfield selected the application of engineering investigations to the hatters' fur-cutting industry. At the time of the study there were 36 plants engaged in the production of hatters' fur, employing some 2,000 persons. Five plants were selected for detailed observation, care being taken to include in this group plants representative of modern and old practice and of "good," "fair," and "poor" working conditions.

Preliminary studies included a sanitary survey of the various workrooms in each plant, and an occupational survey designed to indicate the particular hazards associated with each occupation. It was determined that the principal occupational health hazard to which the workers were exposed was mercury vapor and mercury-impregnated dust in concentrations ranging from 0.6 to 7.2 mg per 10 cu m of air. This exposure results from the use of a mercury solution in the treatment of fur prepared from the pelts of hares and rabbits. The importance of a thorough study is indicated by the unexpected nature of the results; first, the particular occupations that had formerly been thought to be the most subject to exposure were actually found to be well down the list, and, second, the small "back-shop" type of plant with extremely unsanitary conditions proved actually to have relatively small amounts of mercury vapor in the air as compared with the larger plants. Logical explanations were found for both these seeming inconsistencies.

Local Exhaust Ventilation as Applied to Two Processes in the Hatters' Fur-Cutting Industry
Left, Brushing Machines; Right, Cutting Machines

"Environmental study" showed that there were three methods in use in the industry for controlling the mercury hazard. The first was segregation of the workers handling untreated skins; such segregation, if complete, would completely protect about 21 per cent of the workers from mercury exposure. The second method was local exhaust ventilation for use with the equipment creating dust. (It is interesting to note, in this connection, that though a number of such ventilation systems had been installed, their efficiency had never been investigated; in fact, they had been put in chiefly to eliminate the dust nuisance, and their "efficiency" had been based on the visual improvement secured.) The third method, applicable especially to piling-rooms and storage basements, was simply good natural or mechanical ventilation. Natural ventilation was found to be inadequate, however, unless a positive sweep of fresh air could be maintained. The studies showed that in those plants practicing these various methods the mercury exposure could be reduced to "safe" limits as indicated by clinical observations.

Mr. Bloomfield's paper concluded with a discussion of trends in the field of industrial sanitation. The magnitude of the problem was stressed, it being pointed out that there are 15 million workers employed in industrial occupations, many of which are known to be associated with hazards capable of being dealt with by an industrial sanitation program. "The rapid growth of industrial legislation," said Mr. Bloomfield, "and the realization that it is poor economics to have an unhealthy working environment, have tended to an increase in industrial hygiene services, not only in state and local government but also in industry itself. All these factors have brought about a decided demand for trained industrial hygienists, especially engineers. It is felt that industrial sanitation should continue to offer new opportunities and responsibilities, and test the ingenuity and ability of the engineering profession, for many years to come."

Planning Commissions and Public Housing Authorities

RENEWED ACTIVITY in the public low-rent housing field has recently reopened the question of functional relationship between planning commissions and public housing authorities. Three papers on various aspects of this problem, delivered on January 20, 1938, before the City Planning Division at the Annual Meeting of the Society, are summarized herewith.

In the first of these, William J. Fox, Assoc. M. Am. Soc. C.E., describes, from the regional planning point of view, not low-rent but "no-rent" housing. The project for housing unemployable indigents undertaken by Los Angeles County promises a marked saving in contrast with payment of rent and utilities for such persons in privately owned buildings.

The paper by T. T. McCrosky, Assoc. M. Am. Soc. C.E., dealing with city planning and housing from a municipal standpoint, describes the ideal division of functions between the municipal housing authority and the planning board on the one hand and between the former body and the U. S. Housing Authority on the other.

In the final paper of the symposium, Joseph Nevin discusses the question from a state-wide viewpoint. The 565 New Jersey municipalities are characterized by small size and patchwork arrangement, and the absence or inadequacy of city planning commissions has compelled the State Housing Authority to undertake activities which are properly functions of planning commissions.

Los Angeles Project for Housing Indigents

By William J. Fox

Associate Member American Society of Civil Engineers
Chief Engineer, Los Angeles County Regional Planning Commission, Los Angeles, Calif.

MORE than half of all the taxes collected by the county of Los Angeles is devoted to welfare and relief. In 1937–1938 this portion amounted to $26,000,000, and the County Board of Supervisors is examining every possible means of reducing the cost. One item is to provide shelter for permanently unemployable indigents, rent alone amounting at present to $670,000 per year. Some data on present conditions and costs in terms of families are given in Fig. 1. It had been held that the county could build its own houses for these people on county-owned property for less than it now pays for rent and utilities in privately owned buildings. On November 9, 1937, the Board of Supervisors referred this proposal to the chief engineer of the Regional Planning Commission for investigation and report as to its economic and social phases.

The proposal was to build 100 houses as an experiment, labor to be furnished by WPA, and materials, plans, and supervision by the county. Naturally the buildings would have to meet minimum standards of construction and sanitation, as required by the various building codes, and WPA has specified further that they must be durable. Moreover, the security of the county's investment would have to be assured not only by the quality of the construction but also by careful choice of location for each project.

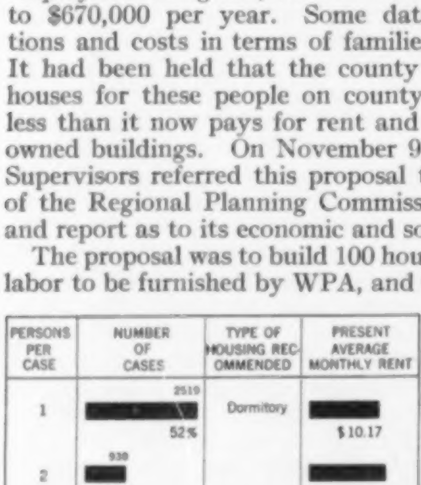


Fig. 1. Case Load, Recommended Type of Housing, and Present Rental Cost for Unemployable Indigents in Los Angeles County

The study shows that the construction of individual dwellings would not be an economic solution for the housing of single persons. For such cases, both male and female, the dormitory idea seems to be the best solution. But small four-room houses were found most suitable to accommodate unemployable destitute families of from four to six persons each. For over ten years the county has paid rent for more than a thousand such families, and the relief authorities consider that they will always have at least this number to care for.

THE STUDY AND SOLUTION

The study was divided into an examination of the design of dwellings, available sites, elements of cost, and social considerations. In the design of the dwellings the aim was to discover the arrangement involving the minimum construction and the most efficient use of space consistent with minimum standards of living for families of from four to six people. The plans used for estimating purposes provide a floor area of 800 sq ft. The layout is characterized by extreme simplicity of plan, concentration of plumbing, and concrete construction with low maintenance. The houses require no plaster and very little interior trim. Moreover, they are vermin-proof and well adapted to the local climate, and can withstand hard usage.

It must be remembered that this is not a low-rent but a no-rent housing project. The families to be sheltered are without any resources whatever, and are charges on the public not because of temporary unemployment, but because of permanent unemployability. The project represents a basic attack at the lowest level, where the county is already solely responsible both legally and morally for housing and care. This project will therefore constitute no invasion of the private field. Such houses will be a vast improvement over the hovels now

occupied by these families, yet are so simple that they can hardly be described as means for pampering the indigent.

Available sites included tax-delinquent properties acquired by the county and land at the Rancho Los Amigos (the county poor farm). Examination revealed that there is sufficient tax-delinquent land available, either in scattered lots or larger consolidated sites, upon which at least 100 houses could be built. A number of consolidated sites were found, not large enough for the entire hundred, but large enough for groups of from 12 to 20 houses, and this led to the study of sites for groups of intermediate size. All sites were analyzed in detail.

Elements of capital cost included land, materials, labor, and installation of utilities. Operating costs will include amortization of the capital cost, reduced to a monthly charge, plus the monthly cost of maintenance and repairs, electricity, gas, and water. The final studies indicate that, at $3^1/_2$ per cent (the rate which the county might expect its funds to earn if invested elsewhere) for 30 years, this total charge can be set at from $10.60 to $12.20 per month, varying with the particular site. At present, the county is spending an average of $19.23 per month per family for rent and utilities, and this, the study reveals, is the most expensive method of solving such a problem. In Fig. 2 appears a breakdown of comparative costs under the present method, and for 16-family and 100-family groupings.

A part of the charge for constructing such houses, however, is a "book" charge, and the actual cash saving per month to the county is represented by the difference between $19.23 and the cost of utilities and maintenance. For instance, in the case of a typical family the cost of utilities and maintenance is $6.50 per month, representing a cash saving of $12.73. On this basis, 100 houses built by the county for $90,000, would represent a total cash saving of $1,273 per month, or $15,276 per year. The saving that could be expected for a minimum case load of 1,000 families would be $152,760 annually. With the present case load of 2,327 families, averaging four per family, the total saving would be $356,400 per year. This saving would return the capital expended in less than six years, whether for 100 or for 1,000 houses. It is this cash saving which is important to the county.

According to the more orthodox method of bookkeeping, the annual book charge could be used to amortize a loan for the original capital expenditure. After allowing for this and for the cost of utilities and maintenance, the saving on 1,000 houses would be $103,560 per year. The figures here given are for groups of from 12 to 20 houses. Differences between the various classes of sites are not great and all offer a distinct saving over the present method, but the use of "intermediate" sites has been found to offer the greatest savings.

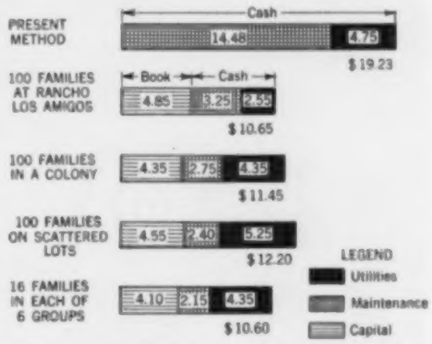


Fig. 2. Comparative Monthly Costs for Different Methods of Housing Indigent Families

Social considerations are intangibles which do not lend themselves to economic analysis, but nevertheless they had to be considered in comparing various ways of meeting the problem. Some apply equally to all solutions. The removal of families from their squalid, unsanitary, and disease-ridden abodes would lessen a menace to the health and moral welfare of entire neighborhoods. Checking disease within the family will save lives and spare the county expense in the future. Case work would be more effective in some respects; rehabilitation would be facilitated; and juvenile delinquency should be reduced.

The undesirable social consequences of housing indigents either on scattered lots or in large colonies are much reduced in the case of smaller groups of from 12 to 20 families. One of the greatest arguments in favor of smaller groups is the fact that in this way racial groups can be satisfactorily placed by themselves, thus avoiding new and serious problems. Groups of intermediate size will not put a sudden or unbalanced load on school facilities. Not only will economies be effected by building in groups, but a small neighborhood can be established with constructive social effect. Maintenance becomes economical yet institutionalism is avoided. Persons living in these groups can be expected to become integrated with the normal life of the neighborhood around them, which would be doubtful in either of the other cases.

Detailed plans are being prepared for the first unit of 20 houses as an experiment. It will be interesting to discover the social effect of putting these families in houses of this character. The result will largely determine the county's policy on future units.

City Planning and Housing from a Municipal Viewpoint

By T. T. McCrosky

Associate Member American Society of Civil Engineers
Project Adviser, U. S. Housing Authority, Department of the Interior, Washington, D.C.

Let us assume that a city has an active planning board but does not have a municipal housing authority. If the planning board has an adequate staff and is on to its job, it is safe to assume that it has a considerable amount of information concerning local housing conditions. This information would have been gathered in the normal course of its work as part of the fundamental studies of living and working conditions, designed to indicate trends in the city's development, and furnishing a basis for the master plan. Its data may have been gathered by field survey or may be entirely the result of abstracting and analyzing information already in the office records of other municipal departments, such as the building department, department of assessment and taxation, health department, or public welfare department. Much of its information may have been obtained from private social agencies and members of the real estate profession. But the

very fact that the information comes from many sources, and has been analyzed by the planning board, means that the board is in a position to know more about housing than any other single department or organization.

Public Works Administration

LARGEST U. S. GOVERNMENT PROJECT REPLACES 12 BLOCKS OF CONGESTED BROOKLYN SLUMS

Williamsburg Houses Provide 1,622 Living Units in 4-Story Walk-Ups

The planning board therefore is the logical city agency to initiate and sponsor a movement to establish an official municipal housing authority. If this movement originates from private sources, the planning board can give it added weight and impetus by supplying supporting data and recommendations. In the state of New York, housing authorities are created by resolution of the common council of a municipality, authorizing the mayor to appoint the members of the authority. The planning board should therefore direct its efforts either to convince the mayor that he should sponsor the adoption of such a resolution, or to persuade the members of the council to vote for the resolution when introduced.

It is generally recognized that there should be the closest possible connection between the planning board and the housing authority, and it has even been suggested that the membership of the two bodies should be identical. This is legally impossible in the state of New York, and in many other states; it has many obvious disadvantages besides. The two bodies have quite different statutory functions, calling for different qualifications and technical experience in their membership. In some cities the housing authority has taken over virtually all the survey and fact-finding functions of the planning board, and the planning board has practically ceased to function. This is obviously a most disadvantageous form of interlocking, since there remains no active and qualified agency to perform such statutory functions of the planning board as approval of subdivisions and reports on changes in the official map.

A satisfactory type of interlocking exists when the planning board and the housing authority have the same chairman, so that the policies of the two can be closely coordinated. However this solution involves finding a rather exceptional man who is both willing and able to give much time to two purely honorary positions. An easier form of interlocking is to have a prominent technical member of the planning board serve also as a member of the housing authority, so that each body can be kept fully informed of the other's activities, in so far as they relate to common problems. The technical member might be a paid city official, such as the city engineer. No attempt should be made, however, to draft the city engineer (or any other official) unless his regular duties are so organized as to permit him to give a substantial amount of time to both the planning board and the housing authority.

In the city of Yonkers, N.Y., a modification of this form of interlocking was worked out. The writer, who served as paid executive of the planning board, was appointed a member of the housing authority. By arrangement with the planning board, a considerable part of his time was made available to the latter body. In this way, the housing authority avoided the necessity for paying a separate executive officer during the long period of studies and investigations when there was no PWA money available, no Wagner Act, and no definite indication as to how soon it might be possible to finance a project. The procedure has disadvantages, since one man with two jobs cannot do as much on either as he could on one alone. In Yonkers we have been fortunate in overcoming this disadvantage to some extent by having a very competent WPA staff assigned to the planning board and another to the housing authority.

WHAT THE PLANNING BOARD SHOULD DO

It is axiomatic that the planning board and its staff should handle all matters pertaining directly to planning, such as control over new subdivisions, preparation of the master plan and capital budget, and study of trends in residential, commercial, and industrial development of the city. By the same token, the housing authority should obviously design, build, and operate housing, for these are its functions. Between the strictly planning functions and the strictly housing functions there is a large border territory comprising the making of surveys and interpretation of all factual data related to both planning and housing.

In general, it is the writer's belief that where its staff is adequate, the planning board should have charge of all surveys, fact-finding activities, and the broad interpretation of their bearing on the life and growth of the city. This view represents the consensus of opinion of housing and planning officials who discussed the matter in detail at the recent conference of the National Association of Housing Officials in Cleveland. The factual information and its primary analysis would then be made available to the housing authority for detailed interpretation and application to the particular problem of improving housing conditions.

In many cases the housing authority will have occasion to request the planning board to make a particular type of survey, or to include additional items in a survey already contemplated. Knowledge of housing conditions is so fundamental to every phase of the city's growth that it would seem more proper to make the obtaining of that knowledge a direct function of the planning board, to be financed by regular budget funds—possibly with the assistance of WPA—rather than to charge expenditures for personnel for such services to the capital cost or annual operating cost of a housing project. This statement refers specifically to cities that already have active planning boards. Where the planning board is inadequately staffed, inactive, or non-existent, the onus of making surveys of housing conditions must fall upon the housing authority.

RELATION OF U. S. HOUSING AUTHORITY TO LOCAL AGENCIES

In general, the U. S. Housing Authority will not need to have any official relations with a local city planning board once a duly constituted municipal housing author-

ity has come into existence. The planning board, however, will wish to make clear, in deeds as well as in words, its eagerness to cooperate with the U. S. Housing Authority. When matters pertaining to surveys are discussed or when information best obtainable through the planning board is needed, a member or officer of the planning board should be invited to sit in at meetings of the local housing authority with representatives of the U. S. Housing Authority. However, the planning board should not have occasion to take an active part in negotiations with the U. S. Housing Authority as this is the direct responsibility of the municipal housing authority.

Preeminently the U. S. Housing Authority is a banker. As such, it must pass upon the soundness of proposed investments in low-rent housing. Being a public banker, disposing of public funds in the forms of loans and grants, it must study proposed investments in much more detail than the private banker or mortgagee. Manifestly, the U. S. Housing Authority must assure itself that every local project conforms to all the provisions of the U. S. Housing Act of 1937. For example, there must be an established need for new low-rent subsidized housing, and proof that the proposed rent schedule conforms to the incomes of the prospective tenants. The Authority must also have evidence of equivalent elimination of substandard dwelling units or an official program to this end. It must analyze locally prepared estimates of construction cost, to make sure that the established limitations on cost per room and per family will not be exceeded. Thus, the federal Authority, although leaving details of design and responsibility for construction and operation to the local authority, must take an active part in the fundamental decisions affecting the merit of all housing projects.

The U. S. Authority will need to study and advise on such matters pertaining to the project site as its size, location, physical character, and the services available to it. The site must be properly related to the community and the city plan, and must be a suitable place for the construction of low-rent housing that will stand sixty years before it is fully amortized.

In the same way, the Authority will have a determining voice as to population density in the project. It will advise as to the most appropriate kind of dwelling types—that is, multi-family apartments, group or row houses, two-family or single-family detached houses, or combinations of these. Standards applicable to conditions in a particular city will need to be set, governing heights of buildings, proportion of land coverage, and placement and spacing of buildings. In these fundamentals, the U. S. Housing Authority is better equipped technically than any but the most unusual local housing authorities.

Similarly, there will need to be an irreducible minimum of non-dwelling facilities, such as recreation rooms, playgrounds, storage rooms, and other community spaces. Without the guiding hand of the U. S. Housing Authority, a local body might unintentionally violate adequate minimum standards, designed to assure not merely a decent place to live but other facilities that promote good citizenship through proper neighborhood environment.

Sizes, use, and arrangement of rooms should be matters for joint consideration by the U. S. Housing Authority and the local authority. The same standards will not apply in all cities, although students of housing are in general agreed that there are certain irreducible minima for room sizes. The matter of proper room exposures or orientations to secure access of prevailing winds and adequate sunshine, light, and air, is similarly subject to the most skillful study and planning that the local and federal authorities can jointly give.

The choice of the type of structural design, whether

Lakeview Terrace in Cleveland, Another Low-Rent Federal Project

$3,800,000 Outlay Provides 620 Living Units in 2- and 3-Story Apartments and Group Houses

fireproof or non-fireproof, wall-bearing or column-and-beam construction, will properly be determined by local conditions, cost indices, and other factors not subject to rigid standards or regulations. In this regard the rôle of the U. S. Housing Authority would logically be that of consultant to the local authority.

In general, the federal authority will be able to confine its functions first to seeing that the terms of the Wagner Act are met, and second, to rendering advisory and banking service to local authorities. As the whole housing program set in motion by the Wagner Act is fundamentally decentralized, the principal responsibility and control rests in the hands of the municipal housing groups. The personnel of the U. S. Authority can give much helpful advice, without which local groups might be unable to do the best possible job at the lowest practicable rent, within the financial limitations of the Act. In order to give the most effective cooperation, the U. S. Authority is assigning staff members as project advisers to make frequent visits to specific local authorities, so that all problems can be taken up as they arise and each project advanced rapidly to the point of actual construction.

SPECIFIC FUNCTIONS OF A MUNICIPAL HOUSING AUTHORITY

At this point it is possible to summarize what a municipal housing authority should do. First of all, data on housing conditions, rents, vacancies, income status, and related matters should be obtained through the medium of the city planning board. With these data in hand the municipal authority should next develop, if possible, a broad program for remedying housing conditions. This program would comprise a series of construction projects to be undertaken over a term of years, arranged in order of urgency. The program would also include recommendations for enforced demolition or closing and rehabilitation of residential buildings throughout the slum areas. In executing this part of the program, the housing authority will need to work closely with the building and health departments. It may find it necessary to sponsor the passage of


Public Works Administration

BOSTON GETS A LOW-RENT FEDERAL PROJECT

$6,636,000 Old Harbor Village Provides 1,016 Living Units in 3-Story Apartment Buildings and 2-Story Group Houses

amendments to the local building code designed to improve living conditions in existing buildings.

If the housing authority is not able to plan a comprehensive program as the first order of business, it may instead work up a single sound housing project so located that it will fit into the broad program to be developed later. It then becomes the responsibility of the local authority to present its case for housing to the U. S. Authority in Washington.

By the terms of the U. S. Housing Act of 1937 it is the responsibility of the local authority to raise 10 per cent of the cost of its projects, either by local grants, by private bequests, or by selling its bonds to state, municipal, or private financial interests. It must present to Washington a definite method for financing this 10 per cent of the cost, and the method must be acceptable to the U. S. Authority, which will furnish the remaining 90 per cent of the cost.

The local housing authority will need to be guided by the experience and counsel of the U. S. Authority in matters pertaining to standards. It must never forget that its principal objective is to create examples of really good housing.

Not only must the members of a local authority be competent judges of local conditions, perhaps with some experience in professions related to building, but they must also have an adequate and competent staff. The local authority and its staff will have to take full responsibility for the preparation of plans; acquisition of land; demolition of buildings; preparation of specifications and construction; inspection of work during construction; selection of tenants; and renting, operation, and management of projects. This is no easy task. It requires ability, energy, and time, as well as the highest integrity. The U. S. Authority in Washington will act as banker, counselor, and friend, but the actual responsibility rests with the municipal authorities.

City Planning and Housing from a State-Wide Viewpoint

By JOSEPH NEVIN

NEW JERSEY STATE HOUSING AUTHORITY, NEWARK, N.J.

THE functions of local planning commissions in cooperation with a state housing authority are not essentially different from their functions in relation to a municipal housing authority. In New Jersey, a State Housing Authority was established to meet a special local condition, but except for the area of operation, its activities have been similar to those of a municipal authority.

New Jersey is a small but densely populated state. Only Delaware and Rhode Island have smaller areas and only Rhode Island has a greater population density. New Jersey contains 116 municipalities of more than 5,000 population; only Pennsylvania has a greater number. Altogether there are 565 municipalities in New Jersey, and their average population is about 7,000. The largest is Newark, with 450,000 population. The smallest municipalities do not contain enough people to fill the offices prescribed for their form of government (one is a golf course and another was an airplane landing field). Small municipalities are as numerous in metropolitan districts as in rural sections.

WHY NEW JERSEY HAS A STATE-WIDE AUTHORITY

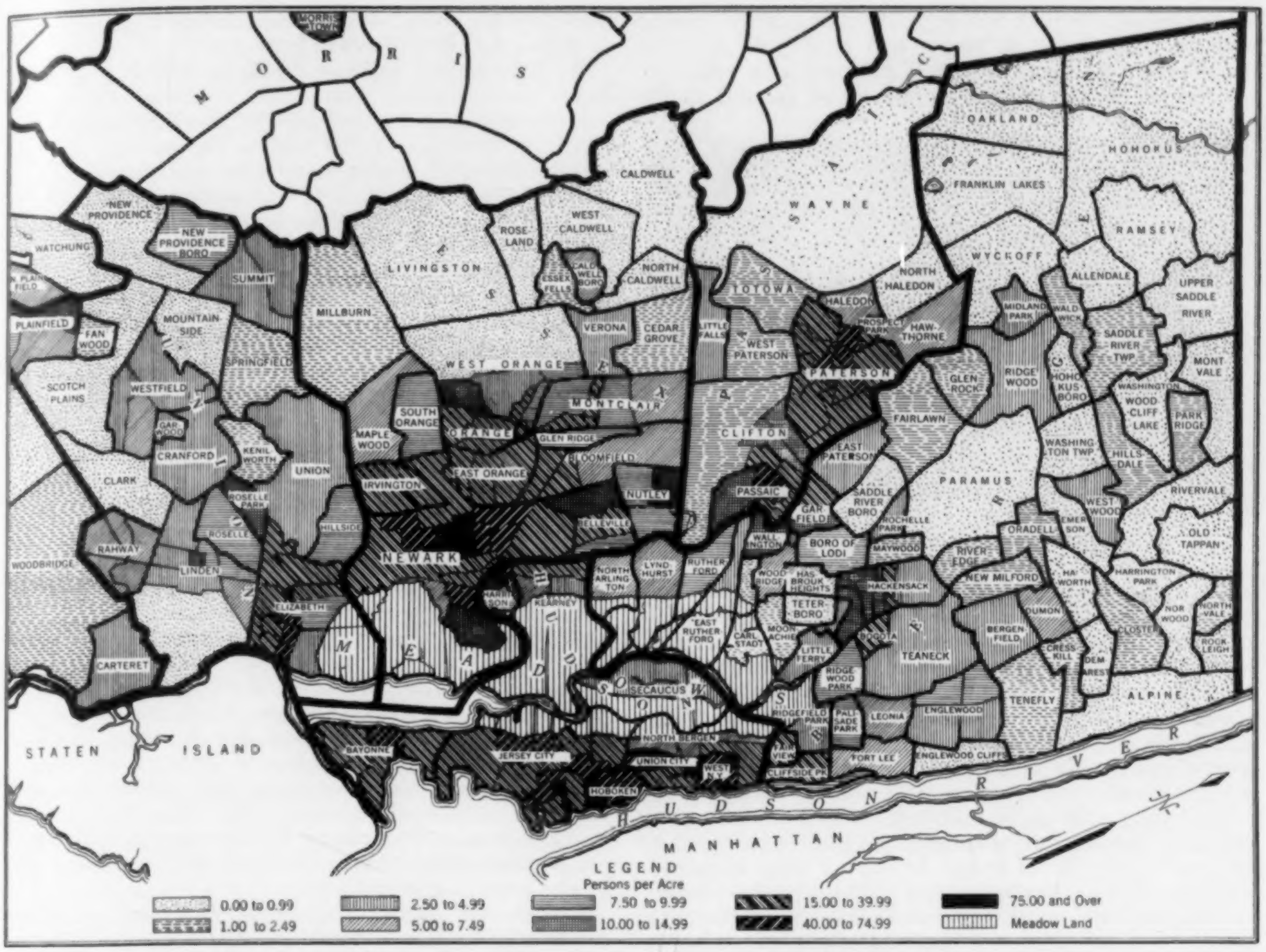
Geographically, these municipalities are of every size and shape and form an amazing patchwork. One municipality will be nearly, or completely, surrounded by another. In several cases, a municipality consists of two separate pieces located several miles apart.

No municipality in the state is a self-contained city. The organic urban unit, containing slums and blighted areas, good residential districts, and business and industrial sections, in New Jersey is subdivided by arbitrary boundaries into a number of municipalities. One of these smaller municipalities may contain all the slums of the organic urban unit. Several others consist of good residential districts and nothing else. Another may include most of the industry of the whole urban unit. Furthermore, the northeast part of the state is a segment of the New York metropolitan region, and the southwest, of the Philadelphia metropolitan region. The influence of these two cities is felt throughout the state.

The need for consolidation of municipal functions, or of municipalities, is widely recognized, and in some fields state-wide administration or control has been effected. For example, tenement-house regulation is under the supervision of a state board.

In introducing a new housing agency into such an intricate maze of governmental units, none of which bear any particular relation to underlying social and economic realities, it seemed advisable to create a single state authority rather than a number of municipal authorities as has been the practice in most states.

State-wide administration seemed especially necessary for public housing because this is so essentially an economic problem. The primary function of public-housing authorities is to make up the difference between the commercial rent of adequate housing and the rent which



Five Counties of Metropolitan New Jersey Contain No Less Than 134 Municipalities
Where Many Municipalities Comprise a Single Planning Area, Planning and Housing Problems Are Unusually Complex

slum-dwellers can afford to pay, and the source of the funds for this purpose may be a determining factor in the success or failure of a housing program.

Under our system of taxation, the revenues of municipalities are derived almost entirely from the taxation of real estate. This system of taxation, being based on capital value, is probably a major cause of slums and blighted areas, for the reason that to the extent municipalities make expenditures for slum clearance, taxes are increased and property owners are obliged to postpone needed repairs, thereby enlarging the blighted area which was to have been eliminated.

Obviously, a housing program which aims at the eventual elimination of slums cannot depend for any large part of its financing on the narrow tax base which is available through the instrumentality of the municipality. This is especially true in New Jersey, where the slums of a number of municipalities are concentrated in a single city without many other ratables. Under such circumstances, the local costs of slum clearance would fall almost entirely on slum dwellers who are utterly incapable of bearing them.

This rather lengthy explanation of some of the reasons which led to the creation of a State Housing Authority in New Jersey is also a partial explanation of the absence or inadequacy of city planning commissions in the municipalities. Regional plans have been completed for the New York Metropolitan District and the Philadelphia Tri-State District. The recently established State Planning Board is progressing rapidly with its master plan, and planning boards have finally been created in most of the important counties. At one time or another, several of the smaller residential communities had well-conceived plans prepared, and years ago, some of the large cities prepared development plans of the wishful type, which have been filed and not followed. But in 1936, only one of the larger cities made a suitable appropriation for the work of its planning board.

Under such circumstances, with the preparation of a city plan largely dependent on surveys of territory beyond the boundaries of the municipality, it was only to be expected that city planning would lag behind county and regional planning. But at the present time city planning boards are urgently needed, if only to give local sanction and effect to the recommendations of the county and regional plans.

In this situation, the assistance that a housing authority might normally expect from a city planning commission has not been available. Nor could the detailed local data which a housing authority requires be obtained from county planning agencies. Of necessity, a state housing authority would be obliged to undertake activities which are properly functions of city planning commissions.

In preparing proposals for housing projects and selecting project sites, consideration must be given to the probable future development of a neighborhood and, consequently, of the city as a whole. The economic

soundness of a project will depend on population trends and on fluctuations in wages and employment. The development of commerce and industry also must be understood if the project is not to be located in its

U. S. Housing Authority

LAUREL HOMES, CINCINNATI, OHIO, HAS 1,039 LIVING UNITS IN 3- AND 4-STORY BUILDINGS

A Federal Low-Rent Project Costing $7,086,000

path. The availability of educational and recreational facilities and the proximity of, or existence of transportation facilities to, centers of employment, shopping, and amusement, are also important factors in project planning. Existing utilities and street layouts affect the project design.

In dealing with these considerations when there is no planning commission, a housing authority is obliged to attempt to do city planning. At least, it must improvise a fragment of a city plan without benefit of the comprehensive surveys which are essential to city planning. In this it is following the example of city departments such as the board of education, or the department of public works, whose activities must be based on their own individual conception of a part of a city plan.

WHAT A PLANNING COMMISSION SHOULD DO

It is easy, of course, to perceive the proper function of a planning commission in relation to a housing authority. On the basis of its surveys and master plan, the planning commission should designate the areas which are suitable for low-rent housing. The exact boundaries of the project site would be determined by the housing authority on the basis of relative ease of land acquisition, requirements of project design, and similar considerations. In general, the housing authority would confine its activities to the project site, dealing with land acquisition, project design, construction methods, tenant selection, and project management.

Such a division of responsibility seems natural and obvious for the planning of slum-clearance and low-rent housing projects. For this purpose and for the development of a well-rounded housing program, precise information about existing housing conditions must be assembled in addition. To compile this factual data on the real-estate market in which the housing authority functions, many real-property inventories have been taken by housing authorities. Such an inventory requires a house-to-house investigation to determine number, type, material, age, and condition of structures; number, size, rent or value, tenure, and occupancy of dwelling units; heating and sanitary equipment; facilities for lighting, cooking, water-heating, and refrigeration; and number and race of occupants, with the time and mode of transportation of wage earners to their respective places of employment.

In New Jersey, because of the availability of relief funds and workers, the State Housing Authority's survey eventually covered 800,000 dwelling units, housing three-quarters of the state's population. In this special situation, where many communities comprise a single real-estate market, it was advantageous to have the survey carried out by an agency having jurisdiction over a large area. However, in the average city, it could be accomplished to better advantage by the planning commission. Much of the data compiled should be as useful to a planning commission as to a housing authority, but the advantage of having all surveys made by a single agency would justify assigning to the planning commission even the collection of data that is useful only to the housing authority. Furthermore, the latter need not be equipped to make extensive surveys, whereas the former must be.

AGENCIES MUST COOPERATE FOR SLUM PREVENTION

Cooperation between the planning commission and the housing authority is most important in the field of slum prevention. As the housing program develops, it becomes increasingly apparent that model housing will never overtake slums if the latter continue to form at their present rate.

One of the principal causes of slums is bad planning and bad zoning. For example, when the area zoned for commercial and industrial use is many times as large as necessary—and this is a common condition—the zoning ordinance tends to promote the development of slums instead of preventing it. The area in nonresidential zones unnecessary for commercial or industrial use is practically unrestricted as regards residential use, in which much of it actually is.

Unless these zoning and planning activities, as well as the standardization and modernization of building codes, the abatement of dirt, smoke, and noise nuisances, and the demolition of unsafe and insanitary dwellings, are carried forward concurrently with the construction of housing projects, the progress of the housing program will be negligible. In the absence of a plan, the board of education or any other department may make mistakes, but such mistakes can be corrected as soon as they become evident and, somehow or other, the function of the department be fulfilled. However, the whole purpose of the housing authority is defeated if comprehensive planning is lacking.

HOUSING UNDERTAKEN TO RELIEVE DEPRESSION AND PROVIDE EMPLOYMENT

It would therefore be reasonable to insist that no housing project should be undertaken until the city had developed a master plan. That such a proposal would not now receive serious consideration serves to illustrate how far housing has drifted from its inherent purpose. We have not undertaken public housing so much to prevent a large portion of our people from languishing in dirt, disease, and misery as to relieve the depression and to provide employment. The real impetus behind the housing movement during the last few years is the desire to make work and to put money into circulation one way or another.

When this pressure is relieved by improved economic conditions, it is to be expected that functions will be allocated to planning commissions and housing authorities on a rational basis. After all, public housing in this country is in an early stage of its development, and its progress will require continual readjustment until a satisfactory arrangement is achieved.

Cost of Energy Generation

Basic Factors; Detailed Analyses of Switchboard Costs; Relative Economy of Steam and Hydro

Continuing its study of the economics of power production, the Power Division presented its second symposium on that subject at the 1938 Annual Meeting of the Society. The present papers follow in logical sequence those of the first symposium, which is now current in "Proceedings," and it is possible that they also will appear in that publication at a later date. The brief summaries presented here can give little more than a bird's-eye view of the ground covered.

Specifically, the present symposium analyzes the cost of steam, Diesel, and hydro power, and combinations thereof, at the switchboard. The papers are only incidentally concerned with transmission and distribution costs; however, it is stressed that these elements may well be the predominant ones in the cost of power to the consumer. The fallacy of a universal "yard-stick" for power costs is emphasized. "Depreciation" comes in for a more scientific treatment than is usually accorded it.

Elements of Power Cost

In opening the symposium John C. Page, M. Am. Soc. C.E., Commissioner of Reclamation, remarked that the mere mention of the word "power" by a government official, especially in connection with the word "water," has in recent years been sufficient "to send large groups of our population into hysterics." As a result, he said, it has been difficult for anyone to approach the subject of power costs calmly, at a time when a calm approach is most needed. Yet, he added, there is nothing in the situation that cannot be rationalized.

Commissioner Page emphasized that each power project is a problem in itself, and that it is unsafe to generalize broadly on the "power theme." "That method of generation which is most economical, and which therefore should yield the greatest social values, in one area may be the most costly in another. Changing conditions also may make that method which was most economical yesterday in any locality more costly tomorrow. These are self-evident facts to the engineering profession, but they have not always been treated as such."

The purpose of the opening paper was to outline the elementary factors in the cost of producing electricity and to indicate their several effects on that cost. Fixed charges, it was pointed out, represent a very large part of the total cost of water power, and are of somewhat less relative importance in steam plants. The principal difference between public and private agencies in the matter of fixed charges is that the private company endeavors to secure a so-called fair rate of return on its investment, whereas the public agency is generally concerned only with interest and amortization. At present both public and private agencies can borrow at from $3^1/_2$ to 4 per cent per annum.

Depreciation on each unit in a power system should be based on the best estimate of its probable useful life. The life expectancy of a hydro plant, for example, may be twice that of a steam plant. Further, in the case of a public project, financed entirely by the sale of bonds that must be retired in say 40 years, it is doubtful whether depreciation should be included on those features that will have a useful life far greater than that—as, for example, a concrete dam.

Taxes are an important item in the fixed charges of a private power company. In certain instances publicly owned power systems have voluntarily included taxes in the rate base, and this seems desirable. In general, fixed charges are considerably higher for a private than for a public power agency.

Operating expenses of hydro plants, Commissioner Page pointed out, are practically independent of the output; in steam plants, on the other hand, where the cost of fuel is the major factor, the operating expenses do vary with the load. As a result, improvement in load factor has a somewhat greater effect on reducing the cost of hydro power than it has in the case of steam. It is, however, of decided importance in either case.

The power factor is also to be considered. With a low power factor, additional carrying capacity must be provided in generators, transformers, and transmission lines, thus increasing the cost of power. Long-distance transmission lines tend to correct a low power factor, but plants located near the load center must either be able to carry the increased current resulting from it, or be equipped with synchronous condensers to correct the condition.

The extent to which a power system is designed to insure continuity of service and close regulation of speed and voltage, is reflected in the cost of power. For example the Boulder power plant supplies both Los Angeles and the Metropolitan Water District. The requirements of the former are most exacting, and demand lightning-proof transmission circuits, high-speed oil circuit breakers, and so forth. The latter, on the other hand, can tolerate brief outages (since such occurrences involve only a temporary shutdown of pumps), and the cost of its transmission lines and generating equipment is correspondingly lower.

Dependability of service must also be taken into account in fixing the required amount of spare capacity in a system. In general the dependability of hydro generating units is substantially greater than that of steam units.

The market for power and the length of time required to absorb the power output must be carefully considered in determining the economic feasibility of a power development. This is particularly important in the case of large hydro projects, as they involve a relatively large initial capital outlay. Annual charges on such a project may exceed annual revenues for several years, possibly to such an extent as to make the project economically unfeasible.

The large federal multi-purpose projects of recent years are essentially conservation projects of national scope, and the power they make available, while important from the standpoint of defraying part or all of their cost, "is incidental and subordinate to the other more vital functions." The cost of this power depends largely upon the allocation of cost among the various functions served. Thus \$25,000,000 of the cost of the Boulder Canyon Project has been assigned by Congress

to flood control, and the division of costs at Bonneville between navigation and power is now under consideration. Grand Coulee is primarily an irrigation project, and cost allocation to power should be taken up at the proper time.

"It is useless," said Commissioner Page, "to argue that the federal government should not build projects of this type simply because they also generate power. Social considerations demand their construction and also demand their full utilization, so that the potential energy they create must be developed and made available for use. . . . The engineer has spent much of his time with the formulas of the power industry, but has devoted too little thought to the implications, social and otherwise, of what he has wrought. Has not the time come for him to apply more of his effort to the determination of a sound basis for settlement of the power question?"

Cost of Heat-Generated Energy

THE COST of power is an extremely flexible expression, as C. F. Hirshfeld and R. M. VanDuzer, Jr., of the Detroit Edison Company made quite plain in the second paper of the symposium. The cost with which they are concerned is "the total cost to the producer, at the point of generation and ready for delivery to the transmission or distribution system"; and "total" includes not only the cost of labor and fuel and other supplies, but "all supervision, all allowances for depreciation, taxes, and all other forms of overhead expense." Their figures are based on the net output of the plant—that is, on the amount of power actually delivered to the line. It is obvious, they say, that this cost "tells a very small part of the story, and that many fallacious conclusions may be drawn with respect to power cost under different conditions if this fact is not fully appreciated. If the power is to be retailed over a wide area it is quite possible for a legitimate cost to the consumer to be seven or eight times the power plant cost, and to vary widely each side of these figures."

The chief feature of the paper is a series of cost curves, one of which is reproduced herewith as Fig. 1. The curves are intended to give a "reasonably fair picture" of the performance to be expected of plants operating at different steam pressures and steam temperatures, "choosing the values so as to cover the entire field as it is found today." The selected nominal values were: 225 lb, 650 F; 400 lb, 750 F; 600 lb, 825 F; 800 lb, 910 F; and 1,250 lb, 925 F. Since "no fixed and definitely predictable thermal performance can be assigned to any single combination of steam pressure and temperature," the authors have used "bands" or "ranges" in preference to definite curves that would imply an accuracy that could not be justified. The values used as upper and lower ranges are not the results of theoretical calculations. They are obtained from actual plant performances under the widely differing conditions found in practice.

Many assumptions have been necessary in preparing these curves, but each assumption is carefully indicated and the method of adjusting the curves to meet the requirements of a particular situation are given in detail, where such adjustment is possible. For example, a plant back pressure of one inch of mercury is assumed throughout; but as the amount of back pressure has a marked effect on the thermal performance of the plant, a correction-curve is provided to take care of this factor.

In any such general study it is not practicable to show completely the effects of all the possible characteristics of load on the thermal efficiency of a plant. Accordingly, the authors have contented themselves with the use of the one factor which can be regarded as the most general in character—the annual capacity factor. The range

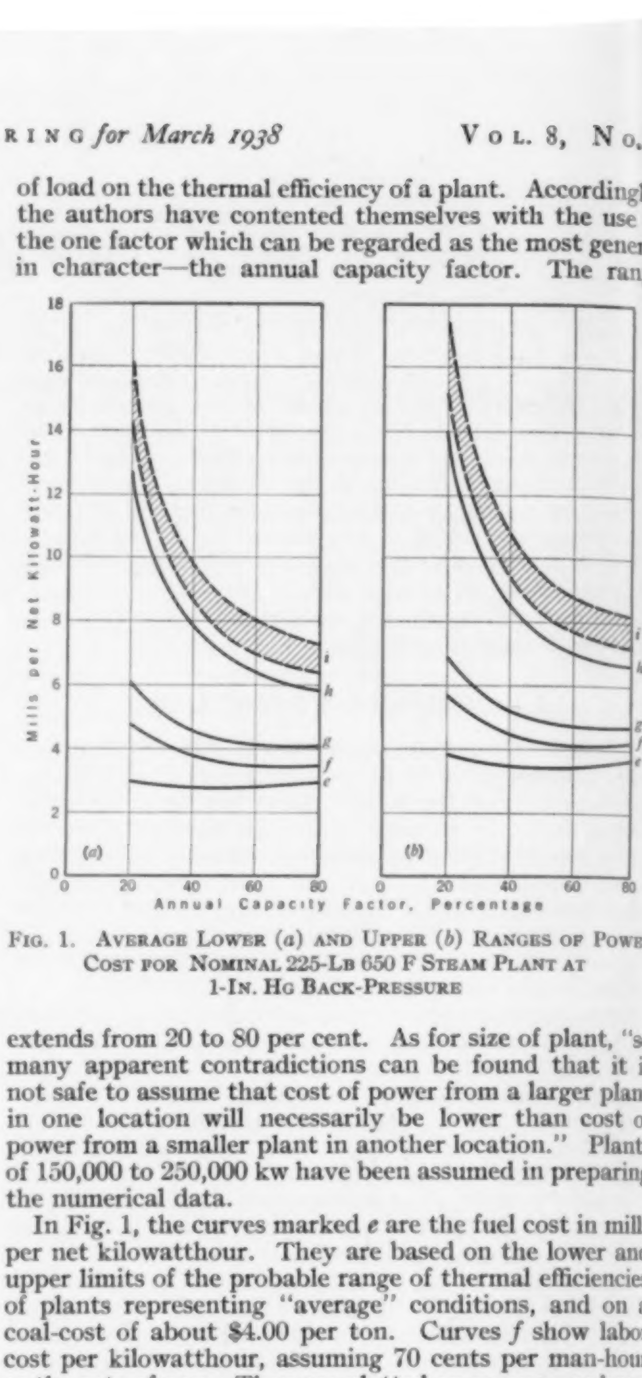


FIG. 1. AVERAGE LOWER (*a*) AND UPPER (*b*) RANGES OF POWER COST FOR NOMINAL 225-LB 650 F STEAM PLANT AT 1-IN. HG BACK-PRESSURE

extends from 20 to 80 per cent. As for size of plant, "so many apparent contradictions can be found that it is not safe to assume that cost of power from a larger plant in one location will necessarily be lower than cost of power from a smaller plant in another location." Plants of 150,000 to 250,000 kw have been assumed in preparing the numerical data.

In Fig. 1, the curves marked *e* are the fuel cost in mills per net kilowatthour. They are based on the lower and upper limits of the probable range of thermal efficiencies of plants representing "average" conditions, and on a coal-cost of about $4.00 per ton. Curves *f* show labor cost per kilowatthour, assuming 70 cents per man-hour as the rate of pay. They are plotted on curves *e* as base, and hence their ordinates show the combined cost of fuel and labor. The same method of plotting applies to the remaining curves. Maintenance labor, material, water, and miscellaneous supplies and expense are grouped to give the data for curves *g*.

Curves *h* take into account the fixed charges per unit of output. The investment per kilowatt is taken as $100 and the annual rate of fixed charges as 12 per cent. Curves *h* thus take into account all costs except "general overhead expense." Such data as are available indicate that the total expenses under that heading generally equal from 10 to 25 per cent of the total of all other costs, and these two percentages define the upper and lower limits of the bands *i*, which are the total plant cost of power.

The prominence achieved by Diesel engines as prime movers for power generation during the past few years justifies their consideration in any study of the cost of heat-generated energy. Accordingly, Messrs. Hirshfeld and VanDuzer have also prepared cost data for Diesel plants paralleling the treatment used in presenting data for steam plants, "so that the two shall be as nearly as possible directly comparable." However, the Diesel costs are based on small installations (say 10,000 kw and

less). They have taken fuel oil at 5 cents a gallon, investment at \$135 per kw, and annual fixed charges at 13 per cent.

Comparison of the data given shows plainly that the modern steam plant is capable of producing power more cheaply than the Diesel, both with and without the consideration of fixed charges. "It should be noted, however, that this result is obtained by comparing values for very large steam plants with those for much smaller plants equipped with Diesel engines. In the case of plants of the size represented by existing Diesel installations, the Diesel engine may still give cheaper power than steam. The competitive situation in these sizes is at present in a state of flux because of many current attempts to build cheap, reliable, and thermally efficient steam equipment in the smaller sizes. Progress made thus far appears to the authors to indicate a real challenge to the supremacy of Diesel engines in this respect."

Cost of Hydro-Generated Energy

The cost of hydro-generated energy was discussed by H. K. Barrows, M. Am. Soc. C.E., consulting engineer and professor of hydraulic engineering at Massachusetts Institute of Technology. The use of hydro in a power system, he said, is now generally considered as complementary to the use of steam, and where hydro is available at reasonable cost it is advantageous to have a considerable proportion of it in the power system. In the wetter seasons of the year, the hydro plant can be used to carry some or all of the base load, thus saving principally in fuel cost of steam plants. In the medium and low-water seasons, the hydro can be used to carry peak loads, thus saving in respect to steam capacity.

In carrying peaks, the hydro plant requires pondage capacity so that the available river flow can be held back during the non-peak portion of the day and released during a relatively short period. In this manner the primary capacity of the plant may be three to ten times or more (depending on the system load curve) what it would be if used through the entire day.

In the case of isolated hydro plants not connected with a power system, the primary output in the low-water season limits the value of the plant in competition with steam or other power. Used in a power system as previously described, the two elements of capacity value and energy value must be included to arrive at the fair comparative value of the hydro plant.

It is suggested that the value of the hydro peak capacity in terms of steam-plant cost be credited to the cost of the hydro plant, correspondingly lessening its fixed charges. The remaining cost per kilowatthour, including allowance for operation and maintenance, would represent the cost of hydro energy alone, which would compete with the fuel and attendance cost of steam power.

As a basis for study, Mr. Barrows has obtained costs and other data from 57 hydro plants scattered throughout the country. The individual plants vary in size from 400 kw to 252,000 kw, under heads of from 13 to 2,561 ft, and in cost from \$91,000 to \$50,450,000. Their aggregate capacity is 2,250,000 kw, and their total yearly output is 9.5 billion kilowatthour (about one-fourth the total public-utility hydro output in the United States in1936).

The cost of plant per kilowatt of capacity, he found, varies markedly with the head utilized and with the size of plant, tending to lessen as head and size increase. This was also true of the cost per kilowatthour of output, though the latter was of course particularly affected by the plant capacity, or use-factor—the ratio of the actual output to that if the plant had run steadily at capacity all the time. The average capacity factor was 0.45, but individual plants ranged from about 0.10 to 0.94. The range in costs was as follows:

Head, in Ft	Cost per Kwhr, in Cents	
	Actual	Adjusted to Capacity Factor of 0.5
Under 100	0.3 to 3.7	0.2 to 1.2
100–500	0.2 to 2.2	0.3 to 1.1
Over 500	0.35 to 1.3	0.25 to 0.55

The "adjusted" costs bring out clearly the range due to variation in what may be called the "site-cost" factor—that is, the natural conditions at hydro sites tending towards a greater or less construction cost of plant.

The principal factor in the cost of hydro power is the yearly fixed charges on capital investment, including interest, depreciation, taxes, insurance, and so forth (Fig. 2). Fixed charges may range from 8 to 11 per cent where private capital is concerned, and are taken at 10 per cent in Mr. Barrows' studies. Because of lower interest rates and other factors, fixed charges on government hydro projects would be 6 or 7 per cent.

Operation and maintenance costs were found to vary from \$6 per kw of capacity per year for small plants (1,000 kw) to about \$0.75 per kw per year for large plants (200,000 kw or more). On a kilowatthour basis, with a capacity factor of 0.5, this would be about 0.15 cents per kilowatthour for small plants and less than 0.02 cents per kilowatthour for large plants. It is thus obvious that in general, operation and maintenance costs are of slight importance in the cost of hydro power.

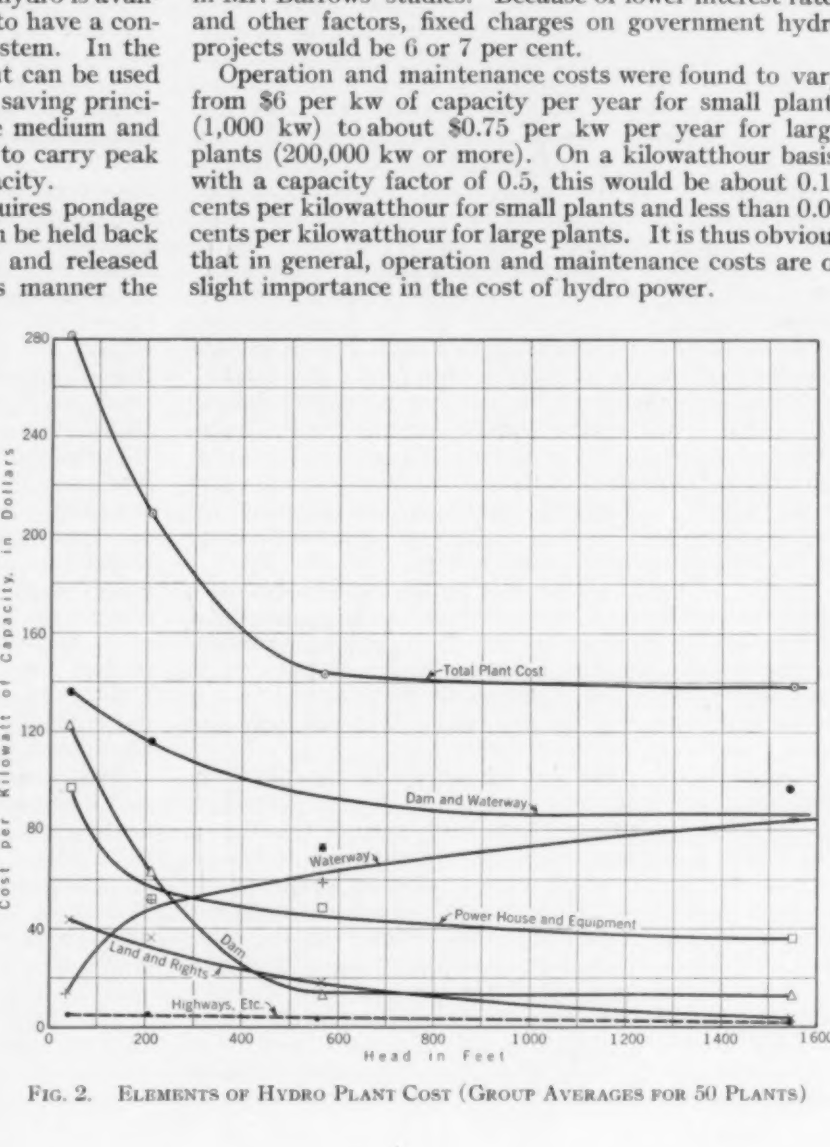


Fig. 2. Elements of Hydro Plant Cost (Group Averages for 50 Plants)

Several large federal hydro power projects were discussed in some detail by Mr. Barrows. He referred particularly to Boulder, Bonneville, Grand Coulee, and the TVA dams, pointing out that the total ultimate capacity of these four projects is 5,430,000 kw, or nearly 50 per cent of all the present developed water power in the United States. The cost of power from them will depend upon the proportion of cost allocated to other purposes and on the basis for determining the fixed charges. It will probably not vary greatly from that for some of the larger hydro plants under private control when considered on the same basis. The federal projects are very large and must, with the exception of Boulder Dam, await such time as their power can be marketed, thus adding greatly to the interim carrying charges.

The total potential water power in the United States available 90 per cent of the time is about 30 million kw. Plant capacities, however, greatly exceed the 90 per cent power, so that about 60 million kw probably represents the capacity required to utilize all these possibilities. (About one-fifth of them are already developed.) The remaining undeveloped powers are chiefly in the western and southern states. Many of them are susceptible to commercial development as the market for power grows.

Cost of Combined Energy Generation

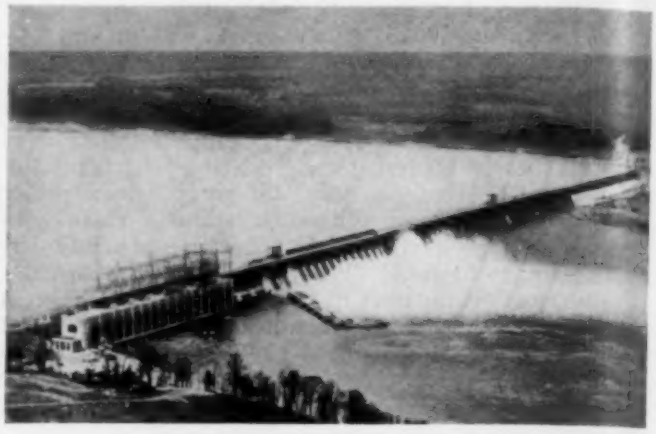
THE METHOD to be followed in determining the cost of combined energy generation was outlined by Ezra B. Whitman, M. Am. Soc. C.E., consulting engineer. Major Whitman introduced his subject by pointing out that the concept of the place of the hydro plant in power systems has undergone many changes in the last 40 years.

At the beginning of that period, the firm capacity of a hydro plant was considered to be only the power it could generate from the minimum flow of the stream. But with the combination of steam and hydro that has developed in recent years, the firm capacity of the hydro plant is looked upon in an entirely different way; it is now possible to use practically all the power that can be developed by a hydro plant in a large system in such manner that the distinction between firm and secondary power no longer exists. Firm capacity can now be defined as "that part of the total installed capacity in the hydro plant which is capable of doing the same work on that part of the load curve of the system that a steam plant could perform." This firm capacity varies with the shape of the system load curve, and does not necessarily come at the time of minimum stream flow.

As the first cost of the steam and hydro plants is a large element in the cost of combined energy generation, it is impossible to ascertain the cost of combined energy in one system and use it as a measure of the cost in another system. The question to be answered in any given case, however, is the same: Will the proposed hydro reduce the cost of power?

Paradoxically, power can sometimes be supplied more cheaply from a combined system than from a system consisting of steam plants alone, even though the cost of the hydro is considerably higher than the cost of that part of the power which is generated by steam. This is possible because the hydro will supply that part of the power in the load curve which comes on the peaks and which it would be more costly to generate by steam.

Major Whitman outlined the method used in determining the value of the Conowingo plant to the Philadelphia electric system when that project was being considered by the Maryland and Pennsylvania public service commissions in 1925. The proposal contemplated six 40,000-kw generating units, and the study included the possibility of increasing the number of units to ten (the stream flow would provide for full operation of ten



THE CONOWINGO PLANT

units for about 20 per cent of the time). The total rated capacity of steam plants in Philadelphia at the time was 476,480 kw; the load factor was 43.8 per cent; and it was estimated that in 1930 the peak coincident load for steam and hydro would be 600,000 kw, of which the steam plants would carry 405,000 kw and the hydro 195,000. In a year of average flow the hydro would produce $51^1/_2$ per cent of the total power required.

Stream flow tabulations were made on a monthly basis of the average flow within the plant capacities for six and ten units, and the power available from these flows was fitted to the load curves so as to obtain the most economical adjustment between the two sources of power. Computations were then made assuming that new steam-generating equipment would be built instead of the Conowingo hydro. Annual charges on such equipment (excluding fixed charges) were estimated to be $12,666,500, or 5.68 mills per kwhr. On the other hand, with Conowingo in operation, the annual charges (other than fixed charges) on the power produced by steam would be $7,163,000, showing a gross operating saving of $5,503,500 to be credited to the hydro.

It was also estimated that with Conowingo constructed it would only be necessary to build 100,000 kw of steam capacity, while if Conowingo were not built, 250,000 kw of steam capacity would be required. Thus Conowingo would take the place of 150,000 kw of steam capacity, which would cost $135 per kw, or $20,250,000. Fixed charges on this hypothetical steam capacity were taken at $11^1/_2$ per cent, or $2,330,000, and the annual charges on fuel, supplies, and equipment were figured at $82,000. The total amount that the Philadelphia Electric Company could afford to pay annually for hydro was thus $5,503,500 + $2,330,000 + $82,000, or $7,915,500.

The annual cost of hydro power was next computed and found to be $7,136,000, which left a balance (representing net savings to be credited to Conowingo) of $779,500. This is a typical illustration of the economic advantage of combined energy generation—and it also illustrates the paradox previously mentioned, for the saving was effected despite the fact that the cost of the hydro power itself was 6.2 mills, as compared to 5.68 mills if all the power had been generated by steam alone.

Major Whitman concluded his paper with a discussion of a number of federal hydro projects. "The fact that the government will start in with only 3 per cent as the cost of the money," he said, "as against double this

amount for private companies, will give the government hydro tremendous advantage over any plant that could be built by private capital. The government is also in a position to wait for the development of a market to absorb its power, and any deficits can be made up by taxation. Private companies cannot spend tremendous sums on projects which it may take years to develop into a paying proposition.

"I am convinced that it is useless to bicker about comparative costs of hydro and steam power, and government owned and privately owned plants. After all, the cost of generating power is the smallest part of the cost of getting the power to the customers. At the most, what is being argued about is a few mills per kwhr. If the government and the private companies would only sit down together and work out a scheme for the most economical utilization of their combined power plants, I feel sure that it would be possible to serve the customers not only to their advantage, but also in such a way that the investments of the private companies will not be destroyed."

Cost of Depreciation and Obsolescence

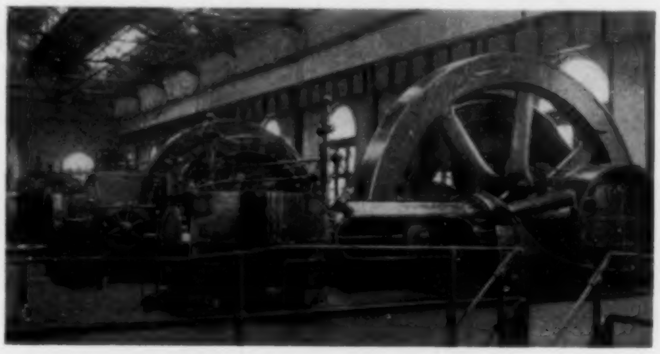
"It has too often been assumed that the meaning of depreciation is dependent upon accounting and regulatory policies and practices," said Maurice R. Scharff, M. Am. Soc. C.E., consulting engineer. "Much of the discussion of the subject has proceeded from the assumption that depreciation is a simple function of cost, time, and the interest rate. More attention has often been paid to the shape of depreciation curves and the forms of the equations expressing them than to the facts they purport to explain."

The causes of depreciation include deterioration, wear and tear, obsoleteness, inadequacy, change in demand, change in use, and requirement of public authority. "And," said Mr. Scharff, "the mere enumeration of these causes suggests that their effects cannot be expressed as any simple function of the passage of time. It is true that the effects of some of them are continuous and more or less regular; but in most cases the incidence of these causes is discontinuous, irregular, and even fortuitous with respect to time." He urged, therefore, that engineers develop a better understanding of the causes of depreciation and the measurement of their effects, and suggested that if progress could be made in this direction regulatory practices relating to public utilities might be brought into harmony with the facts of depreciation. "Part of the confusion of the past has been due to the fact that, in accounting and finance, depreciation has been looked upon as synonymous with amortization of investment."

Where property is used up and disappears progressively with use, "physical deterioration" can be measured in simple units of length, volume, or weight. Again, where the use of property can be isolated for study, it may be possible to measure the progress of deterioration as a function of such use. For example, in the case of wood poles, deterioration through fiber rot may reasonably be measured in terms of decline in compression and bending strength at standard fiber stresses. These are cases in which simple objective measurements of the effects of deterioration appear reasonably applicable.

In many other cases, however, the relationship is less obvious. For example, in the present state of knowledge it would be impossible to agree on any standard series of objective measurements to indicate the extent of deterioration of a steam boiler or the windings of generator coils. Engineering estimates of condition in such cases, therefore, are customarily stated as a per cent of the condition new, and represent mainly the judgment of the engineer—which is of course more or less subjective.

The time may come when the processes of deterioration will be sufficiently understood that several objective measurements may be recognized as completely describing all of the types of physical deterioration that have occurred in an item of property. Mr. Scharff suggested that the Society should invite the cooperation of



In Perfect Condition—but Obsolete. What Is the Measure of Depreciation in a Case Like This?

engineers in other branches of the profession in undertaking to devise such objective standards and to suggest improved methods of arriving at sound engineering judgments and valid statistical inferences.

As a measure of obsoleteness, Mr. Scharff suggested "the decline in the economic value of existing equipment resulting from the development of improved equipment that can be operated at a saving." This decline is, of course, the original cost of the old equipment, plus the sum of the present worths of its operating expenses (exclusive of depreciation or amortization) over a reasonable period of time, minus the corresponding total for the most modern available equipment. Where improved equipment results in greater safety or reliability, rather than in savings in operating expense, the measurement of obsoleteness appears less simple and of a more subjective nature.

Inadequacy, and change in use or in demand, are other causes of depreciation. Inadequacy is rarely encountered, but excess capacity due to decline in market or change in operating methods is not uncommon, and there is opportunity for improving the methods of measuring its effects. It may be analyzed in essentially the same way as obsoleteness.

The "annual depreciation expense" should be the amount needed to make the reserve for depreciation representative of existing depreciation at the beginning and at the end of each year. Of course, a complete new depreciation study cannot be made each year; however, it is possible to approximate within narrow limits the probable change in the amount of existing depreciation during a year. With this in mind, Mr. Scharff outlined his proposed method of computing depreciation. "A helpful guide in many cases," he said, "is to assume that physical deterioration does progress directly in proportion to the passage of time, and that the other causes of depreciation become effective at the time of retirement and can be provided for as retirement losses."

In public utilities the principle has been established that rates are to be based upon allowance of gross revenues from sales of service equal to operating expense, plus annual depreciation, plus a reasonable return on the fair

value of the property used and useful in the public service. And fair value must be based on cost of reproduction (or on "prudent investment") less depreciation. The courts tend to insist that depreciation shall be "actual" depreciation, and that there must be a reasonable correspondence between such actual depreciation and the reserves resulting from the annual depreciation included in operating expense. Recently, for example, the Federal Power Commission has required that each utility shall record as of the end of each month the estimated amount of depreciation accrued during that month. Mr. Scharff believes that the method of figuring depreciation outlined by him complies with the special requirements applicable to the public utilities.

Miscellaneous Comments

IT FELL to the lot of W. F. Uhl, M. Am. Soc. C.E., to prepare the closing paper of the symposium, which in the main summarized the salient facts of the preceding papers. In the present review, however, attention is given principally to those features of Mr. Uhl's paper that were not stressed elsewhere.

"Considering all the variables," said Mr. Uhl, "it must be a mere accident if the cost of power generated in any two stations is the same." With steam plants the most uncertain element of power cost is the variable cost of fuel and the increasing cost of attendance. "During recent years," he added, "the rapid advance in the art of steam-power generation makes it difficult to estimate depreciation and obsolescence." With hydro plants the major uncertainty is the available stream flow; "the extreme conditions of drought and flood are seldom actually known."

The quality of power, as reflected by outages, and by voltage and speed control, should receive consideration. Comparative reliability of operation of two competing sources must also be considered in weighing the "cost of power."

There can easily be a wide difference of honest opinion as regards depreciation and obsolescence. However, present experience indicates that the economic life of a steam plant is probably 20 to 35 years, whereas a well-designed hydro plant may have an economic life of 40 or 50 years. The prevailing practice of superposing high-pressure steam-turbine units on old low-pressure plants complicates the depreciation problem in such cases. The future advance in the art of steam-power generation can alone determine whether the new superposed unit will have a useful life fixed by the remaining life of the older units, or whether the life of the older units will be fixed by the useful life of the new plant.

In making comparisons between capital costs of steam plants, it is important that they be compared item for item so that the comparison will not be misleading. Unfortunately, data published on cost of plants do not always state what is included. Besides the usual itemized account, it is important to know something about land, buildings, foundations, water tunnels, coal and ash handling equipment, boiler and turbine room auxiliaries, switching and substation equipment, and so forth.

Comparisons between capital costs of hydro plants are even more difficult to make, since the natural conditions to which hydro plants must be adjusted are more variable. Further, a comparison of hydro-plant costs based on installed capacity is almost meaningless because the relation between capacity and available stream flow varies so widely. One of the principal difficulties in establishing the true capital cost of hydro plants where the full output cannot be used immediately is the difficulty of determining the added fixed cost on the unused portion of the plant—yet this must be taken into account.

If the cost of power is compared with the cost of other

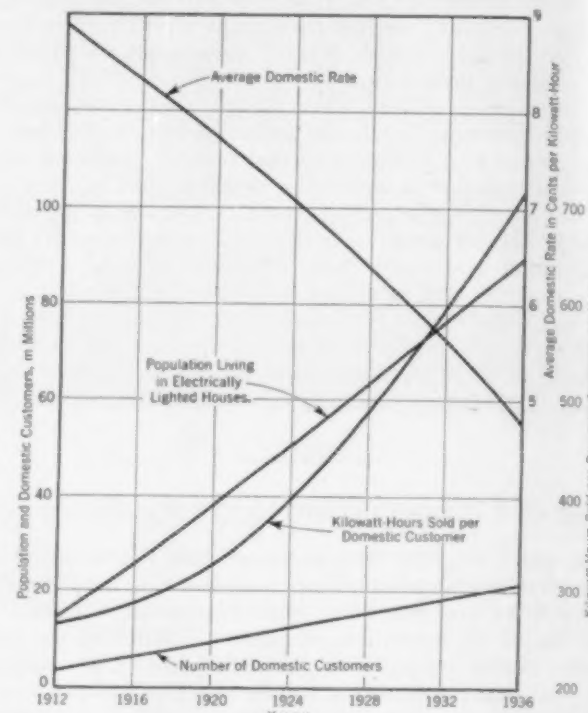


FIG. 3. GROWTH OF DOMESTIC CUSTOMER LOAD AND DECREASE IN UNIT COST OF POWER, 1912–1936

commodities for which there is a similar universal demand, it would appear that the unit cost of its generation is unimportant, particularly since that cost is only a small part of the cost of delivering it to the ultimate consumer. Nevertheless, power use in this country has reached such proportions that small savings in generation are extremely important; a difference of 1 mill per kwhr amounts to $125,000,000 per year over the entire United States. Of course, it is more important to have a reliable source of power than a cheap source that may be unreliable.

Power cost is a relatively unimportant item to many industries, but the continuity and quality of the power supply is extremely important. The ratio of power cost to the total cost of production is small in most industries—less than 10 per cent in all except perhaps a dozen industries, and less than 1 per cent in many.

Power is one of the few commodities whose cost has steadily decreased while the cost of other things has doubled and trebled (Fig. 3). Even during the depression, when the demand fell off materially—and in spite of ever-increasing taxation—the cost of power to the consumer has been steadily reduced. The Consolidated Edison Company of New York, which supplies both gas and electricity to New York City, reports that its tax bill is now about $1,000,000 a week—the largest single item of expense except labor. The tax increase in the last seven years was 70 per cent; in 1930 taxes took 12 cents of every dollar of income, while today they take 20. Yet the rates charged by this company have been lowered sharply in these years, so much so that the bill to consumers was $44,000,000 less last year than it would have been at 1929 rates. If the company paid no taxes, and if the whole tax saving were passed on to consumers, their bills could be cut 17 per cent more.

Architectural Principles of Bridge Design

Esthetic Precepts of Early Times Applicable to the Most Modern Structures

By Wilbur J. Watson

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Despite far-reaching changes in art forms, esthetic principles of architecture formulated by Vitruvius twenty centuries ago are still applicable today, with only those minor modifications required by new methods and materials. Order, symmetry, arrangement, eurythmy, propriety, and economy guide the artist in structures, whether his media be early forms of brick and building stone or modern steel and reinforced concrete. In the accompanying article Mr. Watson shows how these principles have governed the trend of bridge development from the earliest times up to the present, and points out that today engineering, architecture, and esthetics must all be integrated to produce a truly artistic structure. The article is abstracted from the author's address of January 20, 1938, before the Structural Division at the Annual Meeting of the Society.

Nearly two thousand years ago Vitruvius, a Roman architect, wrote a treatise on architecture which enunciated six fundamental principles of architectural design. Vitruvius' conception of architecture was doubtless confined almost exclusively to buildings of stone and brick, and for eighteen centuries these materials continued to be practically the only ones used for buildings and bridges. However, as a result of the advent of the railroad in the nineteenth century and the introduction of new materials, it has become necessary to reinterpret these principles of architectural design and to reexpress them in terms of such new materials—two problems which require a novel conception of esthetics.

The amazing fact about Vitruvius' principles is that, with slight modification, they still apply to modern problems and materials. This is so because his principles are really those of fundamental esthetics—they are not confined to the Greco-Roman architecture with which he was familiar, but are universally significant.

To Vitruvius, architectural design consisted of six theoretical principles or elements, which unite to make a structure a work of art. The first is "Order," which concerns itself with the proper measure and balance of the parts of a work. "Symmetry" is the agreement of these parts with the whole. The third principle is "Arrangement," by which Vitruvius meant proper placing and the adjusting demanded by the nature of the work. The fourth principle is "Eurythmy," the element of beauty, which results from a fitting adjustment of the members. "Propriety" is the perfection of style which results when a work is constructed on approved principles—it includes the principle of functionalism so greatly stressed today. Finally, Vitruvius discussed the proper arrangement of materials and of sites, a thrifty consideration of cost, and common sense in the construction of works, all of which he places under the heading of "Economy," the sixth principle.

The Beginnings of Bridge Design

One of the fundamental forms of all building—the principle of the arch—was known to the ancient Chinese and to the Chaldeans and Assyrians long before the Roman era, but it was the practical genius of the Romans which initiated its extensive use in architecture. The Romans discovered and organized engineering facts which had only been chanced upon before, and under them bridge-building first became a conscious art. The Roman arch achieved absolute beauty and was flawless in expression.

In the design of bridges, the Romans used the architectural orders, together with the detail, merely as decorative features, not as structural elements. An example of this is the Ponte Rotto at Rome, where the "engaged column" (a column placed between arches as a buttress supporting the entablature) is pure ornamentation. It must be remembered, however, that such ornamentation was a natural expression of living art to the Romans.

Various devices were resorted to by the Romans to support their heavy masonry masses. One of these was the corbel, which furnished exterior support for overhanging entablatures. In time this device was ornamented, and it often became a purely decorative feature. Since that period the corbel has become a common detail on bridges. However, as previously stated, the arch was the great Roman contribution to the art of bridge-building; indeed, so forcefully was this fundamental principle expressed by Roman civilization that its influence is still felt.

Bridge-Building in the Middle Ages

After the fall of Rome, no bridges of importance were built until about the twelfth century. During the remainder of the Middle Ages some very interesting specimens were constructed, although the period, on the whole, was not conducive to good bridge-building. Engineering skill and knowledge were almost non-existent. Practically all building design was in the hands of craftsmen who evolved beautiful detail and decoration—as evidenced by the medieval cathedrals—but were completely ignorant of mathematical calculation and the measurements practiced by the Romans. Finally, since the feudal society of the Middle Ages fostered the isolation of communities, there was not much need for bridges except as fortifications.

Many of the bridges built during this period were erected by the priests—especially those of the Benedictine Order, who were known as the *Fratres Pontifices*,

Bridge of Augustus at Rimini, Ancient Italian Seaport

Built About A.D. 14, This Structure Illustrates the Roman Arch with Its Decorative Features

the "Brothers of the Bridge." In order to help wayfarers and wanderers, the monks maintained hospices at bridges and fords which marked important centers for trade and commerce. Thus many of the medieval

PONT VALENTRÉ OVER THE LOT RIVER AT CAHORS, FRANCE
An Example of Fourteenth Century Bridge Architecture Expressing in Its Battlements and Defensive Towers the Military Influence of the Period

bridges supported chapels and chantries, dedicated to saints, on the bridge roadways.

Throughout the Middle Ages, the arch type of bridge remained the most popular. During the early years of that period, the full-centered arch was universally used because the builders had not yet learned to provide for the increased thrusts of the flattened arch. For this reason the roadways were so steep that many of the medieval bridges have been called "ladder bridges." Then, at the beginning of the thirteenth century, the "pointed" arch, one of the leading characteristics of Gothic architecture, appeared.

In medieval bridges there are very few traces of such Roman architectural features as the engaged column and its entablature, except for a few cases in Italy. On the other hand, structures around the Mediterranean, notably in Spain, showed the influence of Mohammedan and Byzantine architecture. The horseshoe arch, the heavy tower, and such details of ornamentation as alternating bands of color on the voussoir—all features of Eastern origin—are to be found in bridges in this locality. The Alcantara Bridge at Toledo is an example.

Generally speaking, the medieval bridge is plainer and cruder than the Roman span, but is much more massive in appearance because it was built with less engineering knowledge. Lack of accuracy always increases waste of material as well as awkward heaviness in design. Thus medieval piers are wide and thick, and often carried up solidly from the cutwater to the parapet, while the openings of the arches are generally relatively small and narrow. Four architectural characteristics which are not essential elements of design were commonly used in medieval bridge building. These are (1) embattled parapets, (2) defensive towers and entrance gates, (3) chapels or chantries, and (4) houses on the bridge roadway. These features reflect the influence of religious and military life upon all medieval building.

During the medieval period the Chinese built some beautiful masonry bridges, many employing the archivolt above the arch extrados—a detail not used in Western Europe until later. Another interesting feature of the Chinese bridges is the timber house with tile roof frequently to be found perched on top of the arch.

The Renaissance was essentially a profound intellectual movement—a rebellion of the individual against external forms. During this period, art came to be regarded as the achievement of the individual artist. Thus there was a revival of interest in philosophic matters, including esthetics. The Renaissance rediscovered the civilization of the Greeks and Romans, among them Vitruvius, whose work formed the basis for two treatises on architecture by Renaissance artists—Adreas Palladio (1518–1580) and Barrozzi Vignola (1507–1573). The writings of these two became universally popular and greatly influenced all design throughout the sixteenth and seventeenth centuries.

BRIDGE-BUILDING DURING THE RENAISSANCE

Bridges in the pseudoclassical style of the Renaissance soon came to be known as "Palladian bridges." This type of structure is readily recognized by its ornamentation—the engaged columns between the arches, the tympanum and coping decorated to resemble the entablature of the column, the balustraded parapet, the arcades with columns and arches, the houses on the roadway, and such detail as the cartouche and sculpture in niches.

Builders of the Renaissance were concerned with the esthetics of construction. Palladio made the significant statement "Bridges ought to have the selfsame qualifications that we judge necessary in all other buildings—they should be commodious, beautiful, and lasting." Because the builders took this to heart during the Italian Renaissance many fine bridges were erected by famous architects—the Trinity Bridge at Florence by Ammanati;

THE ELLIPTICAL ARCH AS DEVELOPED BY JOHN RENNIE, ONE OF THE FIRST PROFESSIONAL BRIDGE-BUILDERS
The "New" London Bridge, Completed in 1831

and the Rialto and Bridge of Sighs at Venice by Antonio da Ponte, who utilized in the former structure the rusticated orders (a new feature introduced in military architecture). Renaissance structures in Paris included the Pont Neuf, with its pointed cutwaters and circular pilasters, which was begun in 1578; the Pont Royal, completed in 1689 by M. Mansart and J. Gabriel; and the Pont Marie, named after its builder, Christophe Marie. The first stone of the latter bridge was laid by Louis XIII and Catherine de Medici.

In the meantime, "Palladian bridges" were being built throughout the British Isles, among them the Pulteney Bridge at Bath, and the so-called "Wren Bridge" at St. John's College, Cambridge. The last-named was the work of Sir Christopher Wren, English

follower of Palladio, who wrote to the Master of St. John's: "You need not be solicitous that the bridge should appear fine to the river and the bargemen. . . . You have only to care for a handsome balustrade, upon the piers of which, for ornaments to the walks, you may set urns, pyramids and statues, even what your hearts or benefactors will reach."

THE PROFESSIONAL BRIDGE-ENGINEER

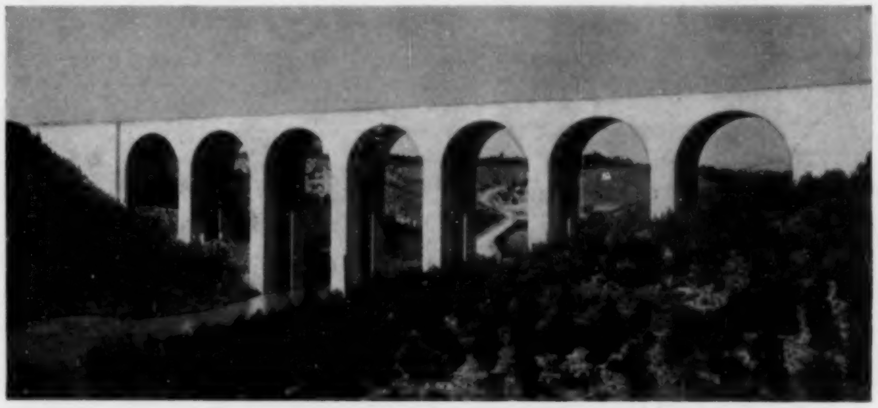
With the eighteenth century, architecture, wearied by the baroque excesses of the decadent Renaissance, turned to the more or less servile copying of (first) Roman and (then) Greek models. But the eighteenth century also saw the rise of many movements which had far-reaching significance, among them the beginnings of democracy and the separation of science and art. Up to that time, bridge-building had been in the hands of the artisan-artist, the priest, or the architect, but now the professional bridge-engineer appeared. Science rather than art became the principal factor in design, and from that time to the present the paths of the civil engineer and architect have diverged more and more, to such an extent, in fact, that a certain need for convergence is now being felt.

Among the first civil engineers to become recognized bridge-builders and the most famous of this period were Jean Rodolphe Perronet in France and John Rennie in England. Perronet is best known for the Pont de la Concorde at Paris and the Loire Bridge at Orleans (built in collaboration with Hupeau). The period marks the beginning of the flat, segmental arch, which was emphasized by Perronet. By the use of this design, a level, or nearly level, roadway could be obtained. In England, John Rennie likewise developed a flattened arch, but this was an elliptical rather than a segmental arch. Rennie's outstanding achievements were the New London Bridge and the Waterloo Bridge, now being rebuilt. Undoubtedly, the elliptical arch is more satisfying esthetically than the segmental, because the former gives a complete curve, the segmental only a part of a curve. From this experimentation it devolved that, in general, simple and complete curves are esthetically preferable for arch rings.

The eighteenth century laid the foundations for the tremendous engineering improvements of the nineteenth. It witnessed the rebirth of civil engineering as a science. For the first time in almost fifteen hundred years, good roads were once more being constructed in Europe. Improved harbors, water works, and canals were built, and sanitation systems begun. Improvements in bridge construction included firmer foundations, the open cofferdam for building in deep water, better cement, and better tools and materials.

These improvements and innovations paved the way for the complete revolution of bridge-building and design in the nineteenth century. The advent of the railroad created the need for spans longer than the masonry arch permitted, and thus forced the adoption of iron and steel. Engineers realized that the new material required new treatment, and evolved other types of bridges—the beam or girder, the cantilever, the truss (including the trussed or braced arch), and the suspension bridge. Unfortunately, however, the engineers of the industrial age lost sight of all principles except those of utility and economy.

Toward the end of the last century, metal reinforcement, embedded in concrete for the purpose of increasing the resistance to tensile stresses, began to be used in bridge-building. As a result of the popularity of this method in Europe and in the United States, a great deal of research has recently been done in reinforced concrete. It must be admitted that, from the esthetic viewpoint, reinforced concrete has some inherent defects which we have not yet been able to eliminate. Its natural color is monotonous and unattractive, and while there is a possibility of coloring concrete the method is not yet perfected. An alternative to this and to the facing of concrete with stone or brick is the treating of it to remove the "cement skin" and thus reveal the "colored aggregates." Another defect from which concrete suffers in northern latitudes is the infiltration and penetration of water and the disintegrating action of frost. The latter limitation is now better understood, and recent work in reinforced concrete is of finer quality. Nevertheless, are we not justified in using older and more proven materials, such as stone or brick, as a facing for concrete bridges?



THE CABRILLO BRIDGE NEAR SAN DIEGO, CALIF., BUILT IN 1915, FEATURES PLAIN FLAT SURFACES

A problem confronting the bridge engineer today is how to express the true function of reinforced concrete—that is, whether it should be exposed to view or covered with other material. Although complicated by the fact that concrete is a combination of two essential materials, one of which is necessarily hidden within the other, this problem is partially answered by the form and size of members. In the Bixby Creek Bridge in California, for example, the columns and beams are of such attenuated dimensions that any layman would realize at once that steel, although unseen, is in reality doing the work. The use of plain, flat surfaces, designed to emphasize the nature of the materials used, also helps the layman to understand that he is looking at reinforced concrete. A few decades ago it was customary to rusticate the surfaces of concrete walls to imitate stone masonry. Obviously, nothing could be in worse taste and nothing could more flagrantly violate the esthetics of design.

THE MODERN RAILROAD BRIDGE

The modern railroad bridge presents another problem. As we have seen, the advent of the railroad changed completely the character of bridges required, demanding the use first of wrought-iron and cast-iron, and then of steel. Although some beautiful steel bridges were built before the present century, the esthetic possibilities of this material, in its general application to bridge design, have only recently begun to be appreciated. Thus the

engineer was forced to evolve new structural methods and new methods of calculation because of these new materials, which were largely artificial. The architect, on the other hand, was not obliged to adapt these materials to structural requirements and continued to treat them as he did the "natural" materials, such as wood and stone.

THE BRIDGE-BUILDER HAS LEARNED TO APPLY ESTHETIC PRINCIPLES TO THE STEEL ARCH
The Washington Crossing Bridge Over the Allegheny River at Pittsburgh, Pa.

Since the eighteenth century, in fact, architecture has done little more than adapt or modify old and familiar art forms to serve changing conditions, materials, and conceptions of beauty—in short, a changing culture.

Obviously, engineering and architecture must ultimately be integrated. The science of engineering has demonstrated to architecture the way of functionalism, the use of new materials, the expression of environment. It comprises the grammar of modern expression for all forms of architecture, and architectural students must be trained to realize that structural knowledge is the essential groundwork for all building, just as the technique of the keyboard is the prerequisite for a pianist. Otherwise, we cannot secure the unity and integration that good architectural design demands. We must also teach our young civil engineers that their profession is an offshoot of both architecture and engineering.

In contrast to the situation in the past, it is engineering which has led the way in, and formed the basis for, the tremendous development of modern architecture. This leadership of the engineer has been acknowledged by many writers. One of these is Jacques Pilpoul, whose "Aesthetics of Bridges" (published in *Le Moniteur des Travaux Publics, de L'Entreprise et de L'Industrie* for February 1931) is worth the attention of all engineers and architects. It is interesting to learn that the first of the moderns in American architecture, Frank Lloyd Wright, never studied at an architectural school but took the engineering course at the University of Wisconsin.

Specifically, the engineering principles which influence modern building are absolute regularity of steel construction, cantilevering, steel columns placed free of partitions, great expanses of glass walls, large roof spans, and the use of new materials such as glass, steel, concrete, and aluminum, with their plasticity and "movement."

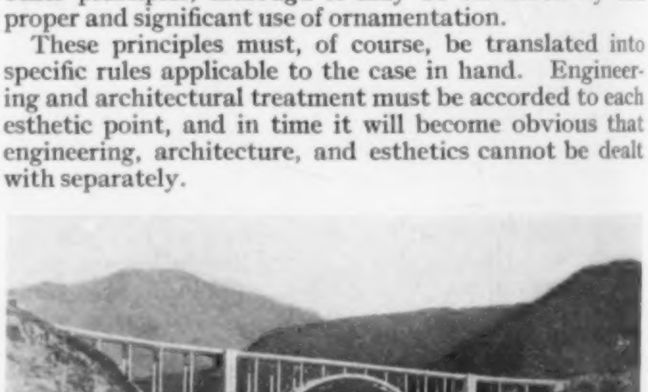
FUNCTION OF THE ENGINEER AND ARCHITECT

Many engineers and architects are beginning to have a mutual appreciation of each other's talent, and it is generally admitted that there is some overlapping of the two professions. There is no essential inconsistency between the idea of esthetics herein expressed and the tenet of modern functional architecture.' The latter does not, as is so often carelessly stated, condemn all ornamentation, and certainly it is obvious that proper ornamentation emphasizes structural members and calls attention to the design. On the other hand, the tenet of functionalism is well illustrated in the George Washington Bridge, where the exposed steel towers are quite generally conceded to be more pleasing esthetically than they would have been if encased in masonry as originally planned.

We have seen that when a civilization has reached a certain advanced state, esthetic expressions of art appear. Apparently our civilization is now entering such a period, and the coordination of engineering, architecture, and esthetics may soon be realized.

In conclusion, a modern reinterpretation of Vitruvius' six principles may be of interest. "Arrangement," in modern terms, may be interpreted as functionalism. "Economy" involves giving, from the beginning, due regard to cost, efficiency of the structure, and the avoidance of unnecessary members. "Order" means that the various parts of the structure should harmonize—in scale, in material, and in detail—with each other and with the whole. "Symmetry" implies that the structure should have balance—a characteristic especially important in the case of bridges composed of more than one span. "Propriety" requires that all parts of the structure should express the natural characteristics of the materials used as truthfully and honestly as possible, without deception or camouflage. The last principle, "Eurythmy" is achieved principally by observance of the other principles, although it may be enhanced by the proper and significant use of ornamentation.

These principles must, of course, be translated into specific rules applicable to the case in hand. Engineering and architectural treatment must be accorded to each esthetic point, and in time it will become obvious that engineering, architecture, and esthetics cannot be dealt with separately.



BRIDGE OVER BIXBY CREEK, CALIFORNIA COAST HIGHWAY
The Attenuated Dimensions of the Members of This Structure, Completed in 1933, Indicate the True Function of Reinforced Concrete

Traffic and Highway Developments

Solving Traffic Problems in Congested Areas; Highway Construction in Mexico

ASPECTS of traffic problems anticipated in connection with the New York World's Fair of 1939 and other present ones encountered in all metropolitan areas were discussed, together with the development of Mexican highways, in a session of the Highway Division on January 20, 1938, at the Annual Meeting of the Society. The three papers delivered at that time are abstracted or summarized herewith.

The opening article, prepared by John P. Hogan and presented by Henry M. Brinckerhoff, describes the preparations being made to transport the expected 40 to 50 million visitors within and without the Fair grounds. The intramural system, which is of interest as it will encounter heavy pedestrian traffic, utilizes three different types of vehicles—buses, tractor trains, and small cars for sight-seeing taxi service.

In the second article of the group, Senor Vázquez outlines the development of Mexico's highways. There were practically no main roads worthy of the name in that country previous to 1925. In that year, however, the federal government embarked on a major construction program. This received great impetus in December 1932, when the federal government undertook to match state funds for building highways.

In the summary which concludes the group, Earl J. Reeder lists a number of traffic problems peculiar to modern metropolitan areas and suggests remedies for them. Until effective means can be found for reducing congestion and accidents in built-up areas, decay and decentralization processes will continue unabated.

Traffic Provisions at New York World's Fair

By John P. Hogan

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DISCUSSION of the problem of vehicular transportation for the New York World's Fair involves consideration of the factors of location, physical characteristics, and expected attendance, as well as knowledge of existing facilities. The World's Fair site (Fig. 1) is located at Flushing Meadow Park in the City of New York, near the geographical center of the greater city, and approximately eight miles east of 42d Street and Broadway.

Occupying a roughly T-shaped area of $1{,}216^1/_2$ acres, it extends $3^1/_2$ miles in a north and south direction, varying in width from $^1/_2$ to $1^1/_2$ miles. Of this total area more than 600 acres are now being intensively developed with World's Fair, government, state, and exhibitors' buildings, with auxiliary roadways, walks, landscaping, and lagoons. The remaining areas will be utilized for terminal stations, for parking interstate buses, and for parking private motor cars.

Large Attendance Anticipated

Situated in the heart of metropolitan New York, the Fair will naturally attract not only great numbers of local residents, but will also act as a magnet for visitors from all parts of the world.

Careful estimates by engineering experts in exhibition production indicate that the minimum attendance to be expected will be 40,000,000, that there is a reasonable hope of an attendance of 50,000,000, and that an even larger attendance is not an impossibility.

An attendance of 50,000,000 for the season of the Fair represents a daily average of approximately 250,000

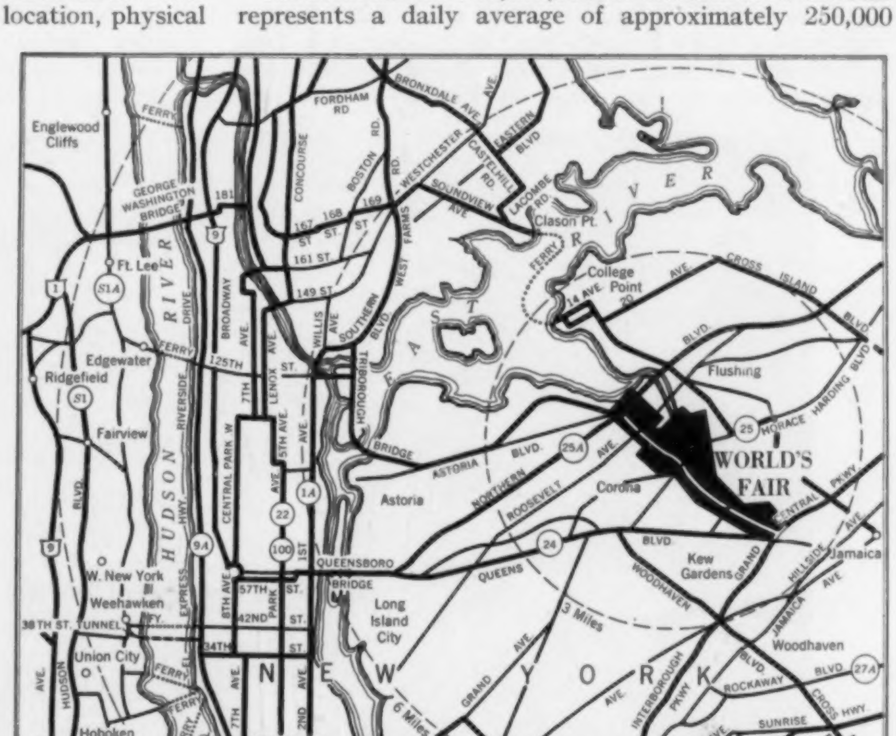


Fig. 1. Site of the New York World's Fair of 1939, Showing Its Relation to the Metropolitan Area and the Principal Approach Highways

persons. Based on the records of other fairs, showing the relationship between the visitors on the average and on the largest days, this average daily attendance would mean that during the course of the season there would be a number of days of 600,000 visitors and a maximum day of approximately 800,000.

Analysis of records showing the hourly arrivals and departures from fairs and amusement resorts indicates that facilities must be provided for handling visitors at the rate of 160,000 per hour. Furthermore, this rush-hour travel must be considered in relation to the travel characteristics of the Fair workers and patrons, respectively. Fortunately, such travel will not seriously aggravate New York's rush-hour commutation problem, because in general it will run counter to the city's business flow, both morning and night.

To provide facilities for transporting approximately 160,000 persons in the maximum hour of large days, nine gates or entrances are planned, as shown in Fig. 2. These entrances, with their capacities, are listed in Table I. Capacities of highway entrances refer to the number of passengers delivered at the gates. The vehicles themselves will not enter the Fair grounds. In computing these capacities the seatings of standard commercial buses have been used, and an average of three passengers per private car has been adopted.

FIXED TRANSPORTATION AND HIGHWAY TRANSPORTATION

A brief description of each of the four fixed transit facilities will be helpful for an understanding of the external and the intramural transportation systems. The Corona Branch of the Interborough Rapid Transit subway and elevated system runs parallel with the north side of the Fair grounds, about 800 ft distant therefrom, and has a station stop at the Fair site. Over this line run subway trains from the heart of Manhattan to Long Island and elevated trains from the southern end of Manhattan to the Fair site. The Brooklyn-Manhattan Transit Company also runs trains serving both Brooklyn and Manhattan over this line. Arrangements have been made for operation of a third track on this line, and for the enlargement of the station at the Fair site. An

TABLE I. CAPACITIES OF ENTRANCES, NEW YORK WORLD'S FAIR

Entrance	Capacity in Passengers per Hour	
Fixed Transportation Lines		
Interborough Rapid Transit, Brooklyn-Manhattan Transit, Subway and Elevated	40,000	
Long Island Railroad	20,000	
Independent Subway	40,000	
Horace Harding-Brooklyn-Manhattan Transit Trolley	15,000	
Total Fixed Transportation Lines		115,000
Highway Entrances		
Administration Building	10,000	
111th Street	20,000	
69th Road	10,000	
Rodman Street	5,000	
Total highway delivery		45,000
Total		160,000

elevated walkway will be provided from the station to the Fair entrance.

The Port Washington Branch of the Long Island Railroad also runs parallel with, and immediately adjacent to, the north side of the Fair. Terminal tracks and a station at the World's Fair will be built, and it is planned to operate fast shuttle trains from the Pennsylvania Station in New York City to the World's Fair station.

Arrangements have been completed for the extension of the New York Municipal Subway line from its Kew Garden Yards at the south end of the Fair to a station to be located on the east side of the Fair at about the middle of its length.

BIRD'S-EYE VIEW OF NEW YORK CITY SHOWING LOCATION OF WORLD'S FAIR GROUNDS

Finally a station is to be constructed in the heart of the Fair, to serve trolley passengers from both east and west.

For those visitors coming by highway, four entrances are provided. On the north, the Administration Building entrance will serve those visitors coming by private motor cars from the west and from the north shore of Long Island, and by chartered buses from various points for a one-day visit to the Fair, remaining there all day and picking up the same load at night for the return journey. A parking field has been provided which will accommodate 550 of these buses. Patrons of this type of transportation may reach the Fair either by the pedestrian bridge or by pick-up buses operating to the Administration Building entrance.

Likewise, an automobile parking field has been provided at the north end of the grounds for motor cars. This field, with a capacity for the simultaneous parking of 12,000 cars, will be under the jurisdiction of the Park Department of New York City, but will of course be operated in close cooperation with the World's Fair management. Automobile passengers will be carried from the field to the Administration Building entrance by pick-up buses.

On the west side of the Fair site, motor-vehicle delivery will be made opposite the central axis of the main esplanade. Here a wide unloading platform 1,000 ft long is provided, on the east side of 111th Street. In front of this platform there is a large open area for the exclusive use of vehicles loading or unloading at the Fair.

Plans contemplate three separate delivery loops at this point. The south loop will accommodate tripper buses from Brooklyn and the south shore of Long Island. (Tripper buses are those which operate on regular schedule through the day and remain at the Fair only long enough to load and unload passengers.) The north loop will be used by tripper buses coming from the north and west, and the central loop by taxicabs and chauffeur-driven private cars. The visitors delivered here will enter the twin entrance gates fronting on 111th Street.

At the south end of the Fair there is an entrance near 69th Road, serving the south parking fields, which have a combined capacity of 9,000 cars. These parking fields will be under the direct control of the Fair management, and it is planned to route into them vehicles coming from eastern and southern Long Island, and Brooklyn. A pick-up bus service will be provided to transport the motorists from the parking fields to the entrance gate.

The combined capacity of the north and south parking fields will be approximately 21,000 cars parked simultaneously. When turnover is considered, the daily capacity should be between 30,000 and 35,000 cars.

The fourth point of vehicle delivery is the Rodman Street entrance on the east side of the Fair. At this point tripper buses, taxicabs, and chauffeur-driven private cars, coming from the east, will discharge their passengers.

HIGHWAY CONNECTIONS AND IMPROVEMENTS

A few years ago the anticipated influx of vehicular traffic from points outside New York City would have presented grave problems, but the construction of great public works in recent years has made possible the handling of the anticipated traffic. Among these may be mentioned the Holland Tunnel, the George Washington Bridge, add the newly opened 38th Street (Lincoln) Tunnel; the Hendrik Hudson Bridge spanning the Harlem River; and the Bronx–Whitestone Bridge across the East River. The last-mentioned structure is now under construction, and is scheduled for completion in time for the opening of the Fair.

The subject of highways in the Borough of Queens has therefore received thorough consideration, and a large number of improvements are actually under way. In this study the officials of all public agencies, both state

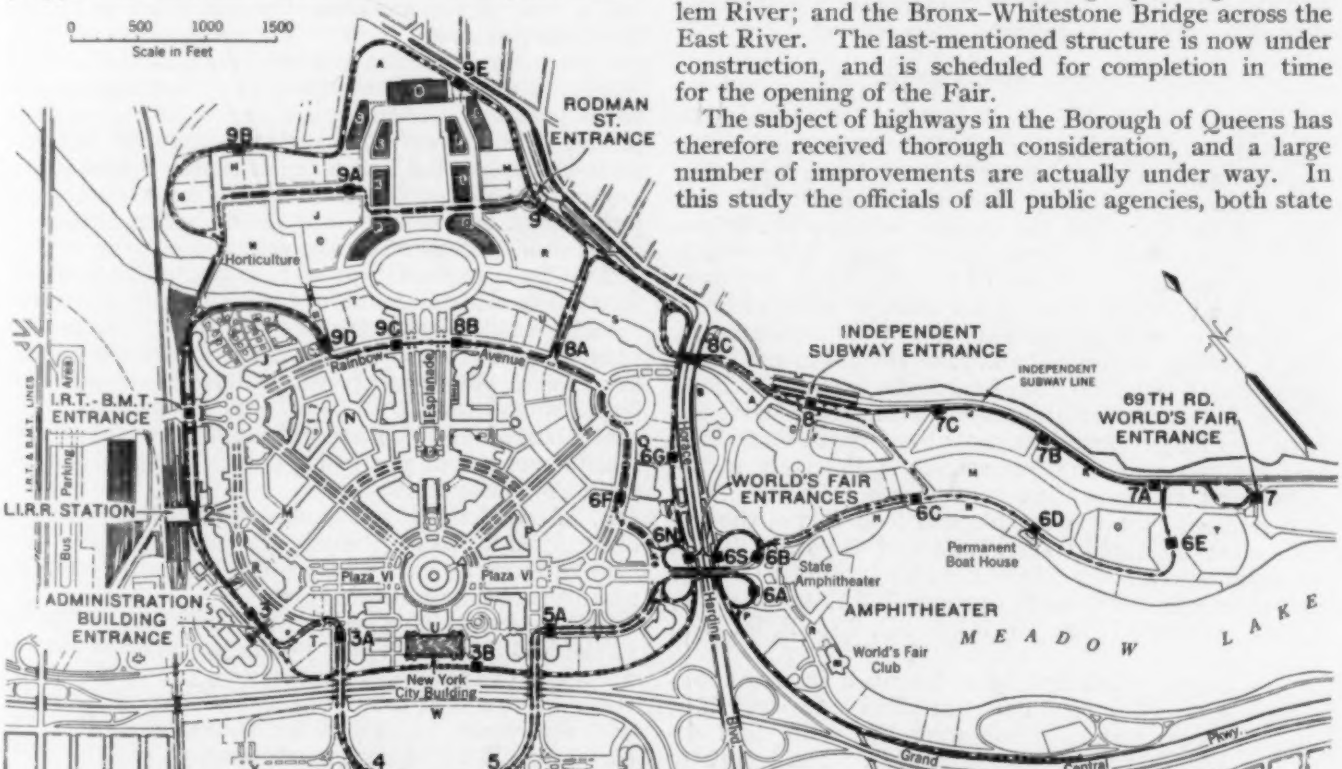


FIG. 2. GENERAL PLAN OF THE NEW YORK WORLD'S FAIR OF 1939
Showing Fixed Transportation Facilities and Intramural Transportation Routes

and municipal, have given splendid cooperation. Figure 1 shows the principal highway approaches to the Fair site.

In the World's Fair area the main east-west highways are now being rebuilt and improved. Northern Boulevard is being converted from a two-lane to an eight-lane highway. Horace Harding Boulevard has been widened to provide three vehicular roadways, with a trolley track in each direction. Sixty-Ninth Road has been rebuilt with a 30-ft width of roadway. Clover-leaf connections have been constructed between each of these highways and Grand Central Parkway, and also at the intersection of Roosevelt Avenue with the parkway.

ARTIST'S SKETCH OF GRAND CENTRAL PARKWAY EXTENSION THROUGH FAIR GROUNDS, LOOKING EAST

The Bridges Connect the Transportation Exhibit Section (Right) with the General Exhibit Section. Between Them Appears the New York City Building

INTRAMURAL TRANSPORTATION

Intramural transportation for the Fair has been planned to consist of (1) a relatively high-speed mass-transportation system, consisting of buses operating on regular routes, giving service between various sections of the Fair and the exterior transportation stations, (2) a system of slower-speed tractor trains which may be operated over any of the streets of the Fair, giving local service, and (3) a system of small electric- or gas-driven vehicles, carrying two or three passengers, which will operate on call and take visitors to any point at the Fair which might be of particular interest to them.

The mass-transportation system has been designed with two major loops, designated the north-south loop and the east-west loop, respectively. Referring to the intramural transportation routes shown in Fig. 2, it will be seen that the north-south loop serves the entrances of the rapid-transit lines and the Long Island Railroad on the north side of the Fair (Stations 1 and 2) and thence passes through Stations 3, 3A, 4, 5, 5A, 6N, 6B, 6C, 6D, 6E, 7, 7A, 7B, 7C, 8, 8C, 8A, 8B, 9C, and 9D.

This route, which has been described in a counter-clockwise direction, will be operated as a two-way line, the clockwise operation following the route just described but in the opposite direction. The length of this loop is 4.66 miles. It will be observed that all the entrances except Rodman Street are reached directly.

The east-west loop follows the same bus roadways to Station 6N on Horace Harding Boulevard. From this point some of the buses will return through Stations 6F, 8A, 9, and 9A.

Operation on this route will be in a counter-clockwise direction. It will be observed that it serves seven of the World's Fair entrance stations and reaches the government area which lies east of Flushing River and is not reached by the north-south loop. The length of this route is 2.73 miles.

From Station 6N at the north side of Horace Harding Boulevard, some of the east-west buses will proceed through Stations 6B, 6C, 8, 8C, 9, and 9A. The length of this east-west route is 3.18 miles.

Buses will not be operated on the roadway east of Meadow Lake, adjacent to the amusement area during hours when the pavement is congested with pedestrians. At such times the buses will be re-routed at the Horace Harding Boulevard clover-leaf so that instead of proceeding south from that point, they will proceed east, through Stations 6G, 8C, 8, 7C, 7B, and 7A to the 69th Road entrance (Station 7). Northbound buses will follow the same route in the opposite direction.

By reference to Fig. 2 it will be seen that detours from the regular bus routes are possible at many points. Should local pedestrian congestion occur, it will be possible to route buses around it and to maintain uninterrupted service. Furthermore, many opportunities are thereby provided for short-looping routes to accommodate the service to the needs of the visitors at different hours of the day, insuring flexibility.

Free body-transfer between the north-south and east-west loops will be given at all points of station intersection. No ticket transfers will be used.

INTRAMURAL HIGHWAYS AND BUS STATIONS

There are three types of intramural highways over which the buses will operate:

1. Private rights of way, such as the Intramural Road and a spur in the amusement sector which is entirely free from pedestrian traffic. The service road following the periphery of Section I of the Fair (the part north of Horace Harding Boulevard) and the roadway parallel to the Independent Subway are also of this type. These private rights of way will provide uninterrupted bus service to all parts of the Fair, even in times of greatest congestion, without grade crossings or interference with pedestrians, and will provide similar access for fire engines, ambulances, and service vehicles.
2. The boulevard type of highway. This is a two-way bus lane in the center of the street, flanked on both sides by parking strips, 13 or 14 ft in width, which will be planted with grass, shrubs, and trees. On the building side of each parking strip there will be a footwalk, varying in width from 25 to 35 ft. Buses operating in the center lane of the boulevard will thus be free of pedestrian interference except at crossing points, which will be controlled by traffic officers.
3. An undivided type of street in which the bus lanes are marked by painted lines. The only example of this type of roadway extends from the Amphitheater to the south end of the amusement area.

The roadways have been studied with care so that the grades and curvatures may permit operation at an average speed of about eight miles per hour. The sharpest curves have a 75-ft radius at the inner edge of roadways, with a pavement width of 30 ft at such points. Roadway surfaces will be either of concrete or of bituminous macadam.

Bus stations on the intramural routes are of several types, depending upon their location and the service requirements. They are located at an average interval of approximately 800 ft.

At the large rapid-transit stations, the passengers, alighting from the exterior trains, will ascend stairways

to a mezzanine level to cross the tracks, will then pass through the World's Fair control, and thereafter may descend either the ramps to the World's Fair streets or stairways to a bus platform located beneath the mezzanine floor. In the case of a bus station at such a point, the platform is in the center of the bus roadway and vehicles stop at both sides, so that the passengers do not cross the bus routes at grade. Control of bus-fare collection is located on the mezzanine level at both sides of the station concourse.

A different type of bus station will be used on the boulevards. Here the station will be located at ground level in the parked strips on both sides of the bus lane. It will be fenced in and provided with equipment for prepayment of fares on both sides of the roadway.

Still a third type of station will be constructed on the route paralleling the Independent Subway. Here, because of the location, it is not feasible to have fare control on both sides of the bus lane, and control is provided on the west side only. Passengers will cross the bus lane under police control to board buses going north.

INTRAMURAL TRANSPORTATION VEHICLES

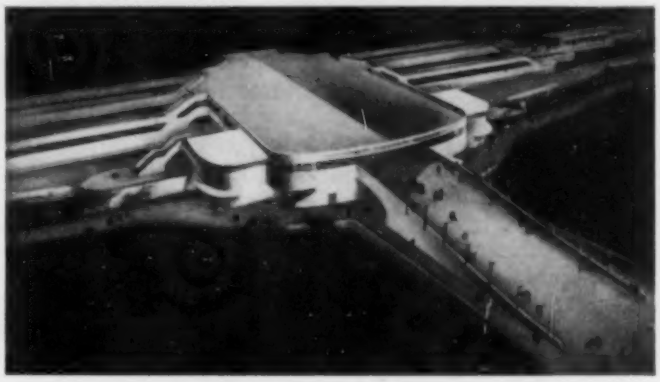
It is estimated that there will be an attendance of 40 or 50 million visitors in 1939, and a large percentage of these visitors will patronize the intramural bus system. Because of this condition and the relatively short mileage of bus routes, the bus to be used should have the largest practicable capacity.

Studies have been made of several types of buses—standard four-wheel, tractor semi-trailer, and full trailer units. The designs submitted show that a unit can be obtained with a seating capacity of between 50 and 60 passengers which will not be too large to operate safely around curves and through stations.

While the final design for these buses has not as yet been adopted, they will be provided with multiple doors on each side for rapid loading and unloading of passengers. The sides of the bus will be open, and the roof will be either open or transparent near the eaves, giving a good view of the Fair, of its higher structures, and of the fireworks and illuminated night displays.

Tractor trains will be provided to serve the various sections of the Fair that cannot be reached directly by the bus transportation system. These will operate over the streets of the Fair, on routes separated from the regular bus lanes, at a speed about that of pedestrians.

One design for a tractor train consists of cars seating 6 or 8 passengers each, with 4 or 5 cars to a train. The cars in these trains track accurately, and no difficulty is expected in operating them around street corners and through crowds. Experience at various fairs, notably at the Paris Exposition of 1937, has shown that such vehicles can operate without undue interference with pedestrian movement and without danger to pedestrians.



Rendering of New York Municipal (Independent) Subway Entrance Located on the East Side of the Fair Grounds
This Is Typical of the Rapid Transit Entrances

A third system of transportation will consist of small vehicles carrying two or three passengers, to be operated at pedestrian speed. Such vehicles may be driven either by electric batteries or by gasoline motors, and may be permitted to operate inside buildings.

While the exact design for these vehicles has not been fixed, it is probable that the passengers will be seated in front of the driver. The drivers will be specially trained so that they can act as guides. The private cars are intended to supply the service elsewhere supplied by push chairs and jinrickshaws.

These three forms of transportation will fill the varied needs of the Fair visitors. Those wishing to ride between distant points only are effectively served by the mass-transportation system. Those who desire to avoid walking between less distant points are effectively served by the tractor trains. Finally, those who wish individual service may use the private cars.

Sightseeing service similar to that in our larger cities will be provided. Vehicles used in this service will occupy stands adjacent to the large entrance stations, from which tours will be made at scheduled times. These trips, which will occupy about an hour's time, will be conducted by a trained guide. Sightseeing buses will not operate on the regular bus routes, but will use other important boulevards, giving the patrons a comprehensive view of the Fair.

Development of Highways in Mexico

By Ricardo L. Vázquez
General Director of the Highway Department, Mexico City, Mexico

Physically, the territory of the Republic of Mexico consists of the northern, central, and southern plateaus, these being cut off from the coastlands by the Eastern and the Western Sierra Madres. The plateaus are separated from one another by secondary mountain systems that run mostly from east to west. In addition, of course, there are the peninsulas of Lower California, and of Yucatán.

This peculiar topography, together with the lack of communication, has isolated the various sections of Mexico from one another, and has hindered development of the nation as a whole. Prior to the arrival of the Spaniards in Mexico, pack and draught animals were unknown and the only means of communication available (excepting the so-called "white ways" opened up by the Mayas in Yucatán) were paths or trails over which men tramped on foot.

After the Spaniards conquered Mexico in the sixteenth century, the only two ports on either sea through which communication with the outside world could be carried

on were Veracruz and Acapulco (Fig. 1). It therefore became necessary to connect these seaports with the capital of the colony, and the latter thereupon became a channel for the whole of the trade with the interior of the Viceroyalty, although, as is well known, only a very small portion of the colony's revenues remained behind for its own benefit. During Spanish domination moreover, attention was devoted only to those roads that were absolutely indispensable for commercial traffic between the metropolis and the interior, and especially to connect mining camps with seaports.

At that time four trunk-line roads issued from the City of Mexico, as follows: Mexico–Puebla–Jalapa–Veracruz, 69 leagues; Mexico–Chilpancingo–Acapulco, 66 leagues; Mexico–Oaxaca–Guatemala, 90 leagues; Mexico–Durango–Santa Fé, 440 leagues. (A Spanish league is 2.6 miles, and the distances I have given must have been measured along a beeline since they differ rather widely from actual measurements subsequently taken along the roads themselves.) Besides these main routes, certain other roads were put in shape to handle traffic, such as the San Luis Potosí, Tampico, Monterrey, Guadalajara, and Toluca roads, which branched off from the main trunk highways previously mentioned.

Throughout the three long centuries of Spanish domination these roads were thronged with dense traffic, and an active trade was carried on, largely in the form of great convoys of pack-mules. Vehicles could only be used to a limited extent, owing to the lack of roads suitable for wheeled traffic.

Late in the eighteenth century the Viceregal Government undertook to build a new main highway from Mexico City to Veracruz. This project met with great difficulties, mostly of a financial nature, and it was not until early in the nineteenth century that the boards of trade of the capital and of Veracruz financed construction of

FIG. 1. GENERAL PLAN OF MEXICAN HIGHWAYS, INCLUDING PROPOSED PROJECTS

the highway, in consideration of the right to collect tolls at different points along the road. Two different roads were built from Mexico City to Veracruz, one via Puebla, Tepehuayalco, Perote and Jalapa, and the other via Puebla, Acultzingo, Orizaba, and Córdoba. These few highways constituted the sum total of the activities along these lines that may be credited to the viceregal governments of Mexico.

The period that elapsed between the proclamation of Mexico's independence and the victory of the Republic over the so-called Third Empire, records no notable advances in our communication systems, but rather a retrogression, due to the neglect of such roads as did exist. This state of affairs reached its peak between the years 1858 and 1864, when the struggle in defense of Mexico's territory often compelled the warring parties to destroy these roads as part of their military operations. During the whole of that period, profuse legislation was enacted on the subject of communications, but the greater part of the laws and decrees then issued (largely contradictory) were never enforced owning mainly to the lack of permanence of the governments that proclaimed them.

SCENE ON THE MEXICO CITY–LAREDO HIGHWAY

During the so-called Empire, Maximilian, looking rather to personal security than military expediency, attempted to keep open rapid communication with Veracruz, and to this end he had the road improved and maintained in good condition. The Cuernavaca road was also kept up in fairly good shape.

Restoration of constitutional order in the Republic marks the time when a more definite policy began to be adopted in the field of communications. Tolls were abolished in 1867, and the following year an appropriation of 1,200,000 pesos, was provided in the budget for means of communication. In subsequent years large amounts were set aside for this same purpose, although as a general thing the full amounts were never actually expended.

Preference for railways over highways first became apparent in 1842, when a concession was granted for construction of a railroad from Veracruz to the San Juan River, a line that later became part of the Mexican Railway. The nine miles of track between these two points was opened for traffic eight years later. The governments of Benito Juarez and Sebastian Lerdo de Tejada gave generous support to construction of the railway to Veracruz, and the latter opened the line by traveling through from Veracruz to Mexico City, on January 1, 1873. However, construction of railroad lines to the northern border met with strong opposition, and it was not until 1880 that work actually began on the railroads to Ciudad Juarez and Nuevo Laredo.

In 1896 the federal government, anxious to concentrate all its efforts on railroad construction, decreed that in states where such lines had been built or were building, highways were to be turned over to the care of local governments. This provision led the state governments to neglect not only highways paralleling railroads but also feeder roads. The only building activity displayed was in the state of Guerrero, where highways were built in 1907–1910, the road to Iguala and Chilpancingo having been completed.

After the Revolution, when the constitutional government of the Republic took hold, a marked tendency soon became apparent to build highways rather than railways, since want of the former had been the cause of economic and cultural backwardness in those sections of the Republic cut off from the rest of the country. To put an end to this isolation and, notwithstanding the many natural obstacles to be overcome, the government decided to adopt a road-building program to connect all sections of the country, and has pursued this plan energetically and steadily, so that it has been carried out in great part.

From 1917 to 1924 only sporadic attempts at road-building were made by authorities here and there, but early in 1925, Plutarco Calles, then president of the Republic, put highway construction on a sound foundation, both technically and financially. He established the National Highway Commission by decrees dated March 31 and August 26, 1925, and equipped it with the necessary technical and administrative staff. To help meet the cost of the work he established a tax on gasoline. During the whole time that the commission functioned (that is, up to April 1932) it was composed of three members—a representative of the executive, a representative of the Ministry of Communications and Public Works, and a representative of the Ministry of Finance.

In the beginning, the funds devoted to highway construction came from the extra tax on gasoline, to which was added the proceeds from the tax on processed tobacco. The laws were subsequently amended, and an appropriation was included in the budget of expenditures to take care of highway construction.

The National Highway Commission's efforts were not concentrated on building federal highways alone, for it assisted some of the states with funds, and by furnishing them with equipment and technical management. This assistance was extended to good-roads committees, military authorities, municipalities, and district committees.

In April 1932, Ortiz Rubio, then president of the Republic, thought it advisable to replace the National Highways Commission with the National Bureau of Highways. He ordered the National Bureau of Highways to seek some efficient and practical means of cooperation with state governments in the construction of highways, as the latter were going ahead without any fixed plan. Furthermore, their roads did not comply with specifications for present-day requirements, so that the funds contributed failed to give desired results. In view of the fact that road-building is of equal importance to both federal and state governments, and in order to concentrate the efforts of the whole nation on this kind of work, on December 22, 1932, an order was issued providing for highway construction in cooperation with local governments. The basis on which this work was to be under-

National Highway Department

THE VALLEY OF THE TAMAN, ON THE ROUTE OF THE MEXICO CITY–LAREDO HIGHWAY

taken was that the federal government would contribute an amount equal to that appropriated by each state government for highway construction; these sums lumped together would constitute a cooperative fund.

TABLE I. EXPENDITURES FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS IN THE REPUBLIC OF MEXICO, 1925 TO 1937, INCLUSIVE

YEAR	DIRECT EXPENDITURES OF NATIONAL BUREAU OF HIGHWAYS	EXPENDITURES UNDER COOPERATIVE SYSTEM	TOTAL EXPENDITURES
1925	$ 5,580,995.73	....	$ 5,580,995.73
1926	10,985,109.40	....	10,985,109.40
1927	6,415,330.63	....	6,415,330.63
1928	9,835,739.41	....	9,835,739.41
1929	8,496,423.06	....	8,496,423.06
1930	15,466,819.17	....	15,466,819.17
1931	16,769,693.31	....	16,769,693.31
1932	9,182,367.45	....	9,182,367.45
1933	8,167,456.44	$ 6,409,909.26	14,577,365.70
1934	12,934,225.10	9,808,898.22	22,743,365.32
1935	17,528,838.59	9,949,932.41	27,478,771.00
1936	34,948,888.53	12,649,197.38	47,598,085.91
1937	28,530,880.56	22,965,816.66	51,496,697.22
Totals . .	$184,842,767.38	$61,783,753.93	$246,626,521.31

This order met with an enthusiastic reception from all the state governments, and the great majority of these at once started highway construction under these terms. As a consequence, the Republic now has a number of exceedingly useful highways, constructed under the cooperative system. These will contribute effectively to the progress and betterment of conditions all over the country, and are destined to become decisive factors in promoting commercial exchange, by affording access to regions hitherto wholly or partially isolated.

Despite the obstacles that invariably arise at the outset when an organization of a wholly novel nature is initiated, and the fact that considerable machinery and equipment had to be purchased for states which lacked them, the immediate results were most satisfactory. Besides opening up new routes and creating fresh sources of wealth, work was found for large numbers of men. Increased revenues from gasoline taxes and enhanced commercial traffic likewise resulted. Such other advantages as improved political life for the nation, promotion of love of country and interest in national problems on the part of all citizens, freer interchange of men and ideas, and gains in the fight against illiteracy will all flow from the construction of good highways. The sums expended and the work done to date are shown in Tables I and II.

When construction of modern highways in Mexico began, to a certain extent, to be actively promoted, it was thought that Mexican engineers were not yet qualified to undertake and carry through works of such magnitude, and the Mexican Government engaged several civil engineers of high reputation in the United States, some of whom were members of the American Society of Civil Engineers, to come to Mexico and take charge of the work. But after a short time we realized that we were, after all, qualified to undertake the construction of highways, and since 1926 we have been able to dispense with outside assistance. It would not be fair, however, if we here failed to recall, with gratitude and affection, the names of such engineers as Haxtun, Upham, O'Connor, Nash, and Cruse, who initiated us in the art of highway building and from whom we learned a great deal.

TABLE II. HIGHWAYS COMPLETED IN THE REPUBLIC OF MEXICO

TYPE OF WORK	UNDER NATIONAL BUREAU OF HIGHWAYS In Km (and Miles)	UNDER COOPERATIVE SYSTEM In Km (and Miles)	1925–1937, INCL. Total in Km (and Miles)
Concrete highways . .		4 (2.5)	4 (2.5)
Paved highways . . .	1,686 (1,047.0)	708 (439.7)	2,394 (1,486.7)
Surfaced highways . .	980 (608.6)	3,510 (2,179.7)	4,490 (2,788.3)
Grading	553 (343.4)	1,133 (703.6)	1,686 (1,047.0)
Totals	3,219 (1,999.0)	5,355 (3,325.5)	
Grand total			8,574 (5,324.4)

Traffic Problems in Metropolitan Areas

PRINCIPAL traffic problems peculiar to thickly populated districts, together with some suggested remedies, were summarized in a paper prepared by Earl J. Reeder, chief traffic engineer, National Safety Council, Chicago, Ill., which was read by Charles D. Curtiss, M. Am. Soc. C.E., chief, Division of Control, U. S. Bureau of Public Roads, Washington, D.C.

A city street, said Mr. Reeder, is not a continuous scene of human and mechanical disaster—in fact, traffic gets along quite well at most places. But accidents and congestion tend to be concentrated at certain points because of difficulties there more serious than individuals can cope with successfully. Accurate and complete accident records are necessary for discovering these "sore

spots" and developing appropriate remedies for them.

Signs, signals, and markings for traffic control are designed to give the individual driver or pedestrian greater assurance that others are going to move in a certain way at a certain time so that he can act accordingly. The resulting restriction or assistance should be sufficient, but not more than is necessary, for safe and expeditious movement of traffic because, after all, human beings do desire to be safe and will act in accordance with their knowledge of the situation. Although control by signs, signals, and markings is getting increasingly complex as regards design, operation, and instructions of the equipment, the traffic planner must make it tell a simple and easily understood story, so that no observant person will fail to understand what confronts him as he drives or walks along the street. The engineer must determine from exhaustive study what should be done at certain danger points and must give the public this information in such a way that individuals can act upon it and not have to depend upon their snap judgment to determine what they should do.

The pedestrian problem is one of increasing seriousness, particularly for persons who have never driven automobiles and hence do not appreciate the limitations of vehicular performance. Too little attention has been devoted to pedestrians in our control measures. We have emphasized the stop-and-go signal as vehicular protection, for example, but have not sufficiently emphasized the importance of obedience by pedestrians for their own protection.

Closely related to the problem of pedestrian protection is that presented by the increasing seriousness of night accidents. Pedestrians, in particular, are susceptible to accidents at night, and proper street lighting is necessary for their protection. There can be no controversy as to the need for proper lighting of city streets where vehicles and pedestrians must intermingle and street intersections are frequent. Good lighting requires more than merely increasing the candlepower of the luminaires; it involves proper spacing, mounting height, position with respect to the street, and types of luminaires. It deals with the placement of lighting units in such a manner as to reveal the objects in the road ahead either by reflection or by silhouette. Furthermore, safety zones, railway underpasses, and other obstructions and dangers should be marked by signs visible at night either by illumination or reflection.

Many merchants and business people believe that traffic density is a sign of prosperity; whereas it may, rather, be a sign of impending business decay and decentralization. In some cities as much as 30 per cent of the traffic passes through central business districts without making any business stops. Means should be provided for such traffic to by-pass congested districts so that these areas can be reserved for business traffic.

Speed zoning is an important new development, in which the maximum permissible speeds, as determined by engineering investigation, are posted conspicuously. Also, proper interconnection and timing of stop-and-go signal systems is effective in speed control. Progressive systems will allow vehicles to pass through in platoons at predetermined speeds. Such designs are controlled by the amount of traffic that must be handled, the block lengths, and the amount of cross-traffic at the different intersections. Speeds must be appropriate for street conditions, and where drivers are unable or unwilling to recognize the practical limitations on their speed, reasonable restrictions must be applied.

Parking in congested business districts is a controversial problem. The primary purpose of access to the curb is to receive or discharge passengers or merchandise, and only after this function has been adequately provided for should the remaining free curb space be used for parking. It is inconceivable that we shall long continue to park

HEAVY TRAFFIC, MOVING IN GROUPS, CONTROLLED BY SIGNAL SYSTEM ON MICHIGAN AVENUE, CHICAGO

cars almost bumper to bumper in busy city streets, and the time should soon come when building restrictions will require all business buildings to have off-street provisions both for parking and for loading and unloading of merchandise. A new development which helps the police materially in enforcing parking regulations is the parking meter. This device shows mechanically the amount of time that has elapsed since a coin was inserted by the driver who parked there and reveals at once any violation by overstaying.

In dealing with these problems of traffic the paramount importance of mass transportation must not be overlooked. In the amount of street space used per person carried, the private passenger vehicle is much less efficient than the bus or street car, and in the restriction of traffic, the latter should be impeded the least.

In concluding his paper, Mr. Reeder emphasized the fact that traffic planning is distinctly an engineering function. Although we are long past the day when trial-and-error methods are appropriate for solving the traffic problem, he said, we still face the necessity for putting our planning efforts to the test of actual results in accidents prevented, congestion reduced, and traffic expedited. Finally, to be effective, traffic planning must be backed up by adequate public education to inform the public about the use of the facilities that are thus provided, and by adequate enforcement to require conformance by those who are willful or negligent in their disobedience or misuse of the facilities.

Reports of Research Committees

As Prepared for the 1938 Annual Meeting of the Society

Special Committee on Hydraulic Research

DURING 1937 the Special Committee on Hydraulic Research made progress in all phases of its planned program. Details are given in the following paragraphs.

CONFORMITY OF MODEL TO PROTOTYPE

The committee has continued to promote comparisons of the behavior of field structures with previous hydraulic model tests. Differences in performance under certain conditions have been found. The committee has encouraged the installation of facilities for obtaining field data. Equipment for making comparisons has been installed at Grand Coulee, Madden, Fort Peck, Norris, and Bonneville dams, and it is hoped that others will soon be similarly equipped. Comparisons have been made also for the Iowa City dam. A paper, "Hydraulic Tests on the Spillway of the Madden Dam," by R. R. Randolph, Jr. (PROCEEDINGS, May 1937), included a number of these comparisons for the Madden Dam.

In many cases it has been found that the final field construction differs from that used in the model, rendering close comparisons hard to obtain. To obtain more exact comparisons the committe is urging university laboratories and others to make model studies of existing structures and to operate them under conditions similar to those actually observed in the field. At Iowa City a thesis is planned on this subject.

PROBLEMS ON FUNDAMENTAL RESEARCH

Considerable progress has been made on research projects sponsored jointly by grants from Engineering Foundation and sums contributed by the institutions concerned:

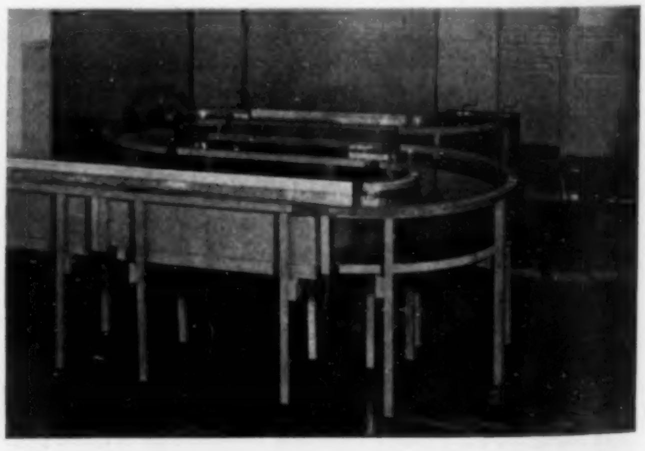
Project 1. "Traveling Waves on Steep Slopes," H. A. Thomas, M. Am. Soc. C.E., Carnegie Institute of Technology, Pittsburgh, Pa. Work on this project has been actively pushed by Professor Thomas with the aid of graduate students, and two theses have been completed, one by R. F. Schnake and one by Frank Morrison. Waves on a traveling belt were studied through a rectangular glass-sided flume. A steep rectangular channel with an adjustable slope was set up and a motor-controlled inlet gate provided at the top for starting wave-trains down the channel. An electrical device for measuring the velocity of the waves accurately was designed and photographs were taken. A critical slope was found below which waves tend to damp out and disappear and above which they tend to increase in size and velocity. For 1938 a study of single waves in the rectangular flume and a study of bores in non-rectangular channels is planned under the immediate direction of J. W. Dougherty.

A questionnaire was prepared and sent to a large number of officials in charge of irrigation projects, control of water over dams and in chutes, etc., in an attempt to obtain field data on the phenomenon of traveling waves on steep slopes. Some data were obtained, among them reports on the traveling waves observed by the Los Angeles County Flood Control District. The committee is also cooperating in this field with the Special Committee on Flood Waves of the American Geophysical Union.

Project 2. "Curves in Open Channels," C. A. Mockmore, M. Am. Soc. C.E., Oregon State College, Corvallis, Ore. Considerable progress was made on this project during 1937. The behavior of the water is being studied by motion pictures. Pyralin channels have been set up and the flow around a 180-deg bend investigated. Considerable difficulty was found in measuring velocities at the bends, and suggestions are being considered for more suitable apparatus. For a ratio of depth to width of about 0.25, the velocities on the inside and outside of the bend were found to be about the same. At higher velocities, the surface water tends to move to the outside of the bend, and the bottom current tends to move towards the inside, producing spiral motion. These studies will be continued with bends of other radii and of different sizes.

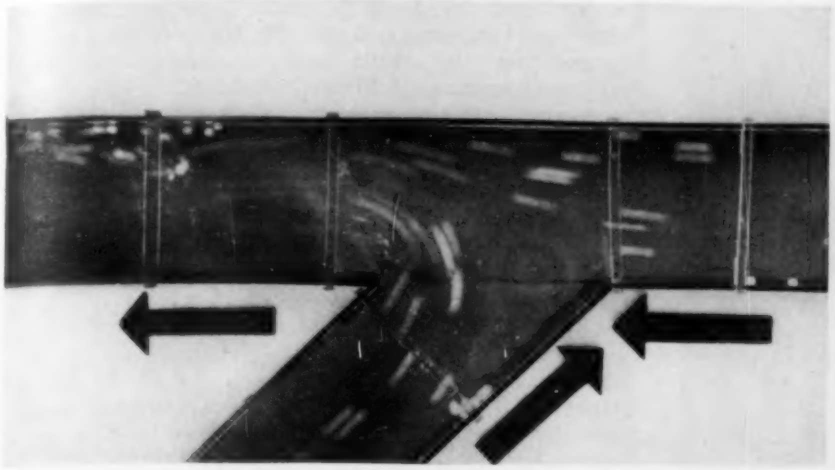
Project 3. "Phenomena of Intersecting Streams," M. P. O'Brien, Assoc. M. Am. Soc. C.E., University of

Project No. 1



Project No. 2

EXPERIMENTAL SET-UP FOR THREE OF THE RESEARCH PROBLEMS



Project No. 3

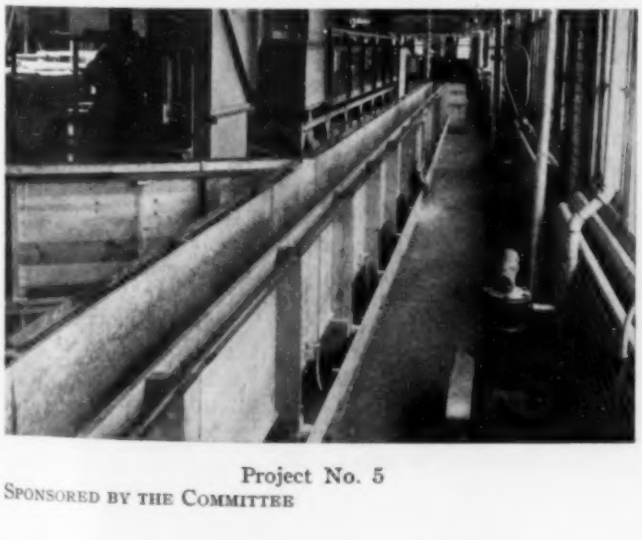
Project No. 4

"Movies" and "Stills" Are Invaluable Aids in Recording Data

California, Berkeley, Calif. After considerable work on this project with small metal flumes, square flumes 4 in. deep have been constructed of pyralin. Experiments have been run with the branch flumes intersecting the main flume at angles of 45, 90, or 135 deg and both delivering water to the main flume. Reversed flow was also used. A thesis, in which the momentum relations were developed, has been prepared under the direction of Prof. R. L. Stoker by Cecil Horowitz and J. R. Morgan on the results to date.

The ratio of the discharge in the branch channel to that in the main channel was measured in each case and found to be closer to the computed ratios for the smaller flows in the branch channel. The direction of the current was studied by means of suspended threads. It is planned to continue the project with various sizes of channel and various angles of convergence and divergence, and to continue measurement of the profiles and velocity distribution.

Project 4. "Conversion of Kinetic to Potential Energy in Expanding Conduits," F. T. Mavis, M. Am. Soc. C.E., University of Iowa, Iowa City, Iowa. The library search of pertinent hydraulic literature made in connection with this project by Dr. Andreas Luksch has been extended to related fields in physics and mathematics. In the laboratory, experiments have been made by Dr. Luksch and E. R. Van Driest on transparent pyralin cones connecting pipes 3 and 5 in. in diameter. The transparent section is about 3 ft long and is immersed in water in a glass-walled box. A suspension of carbon tetrachloride, benzene, and anthrazine is introduced into the pipe, forming globules whose trajectory and velocity can be determined by a motion picture camera. Some particles were observed to move upstream at the sides, and the main jet was observed to oscillate from side to side. Pressure measurements were made and all the data were studied in an attempt to establish a basis for correlating over-all energy losses with erratic changes in velocity of fluid elements through the expanding section. It is planned to continue the investigation by experimenting with other transparent expanding conduits ranging from cones with small central angles to sudden expansion.



Project No. 5

Sponsored by the Committee

Project 5. "Sedimentation at the Confluence of Rivers," L. G. Straub, Assoc. M. Am. Soc. C.E., University of Minnesota, Minneapolis, Minn A main channel 12 in. wide, 24 in. deep, and 65 ft long has been set up and a tributary channel attached. Facilities have been provided for feeding sand to the two flumes independently. Both the angle of convergence and the slope of the flumes can be varied. Control experiments have been made with the sand which is to be used for the confluence tests. A special tilting flume was constructed for this purpose and for making check runs on the characteristics of the material during the course of the experiments. The sand was caught in a trap at the end of the flume and weighed continuously. The water-discharge measuring devices for the confluence flumes have been calibrated, and it is planned to add the same bed load to both flumes and to vary the angle from 15 to 90 deg.

Graduate Student Research

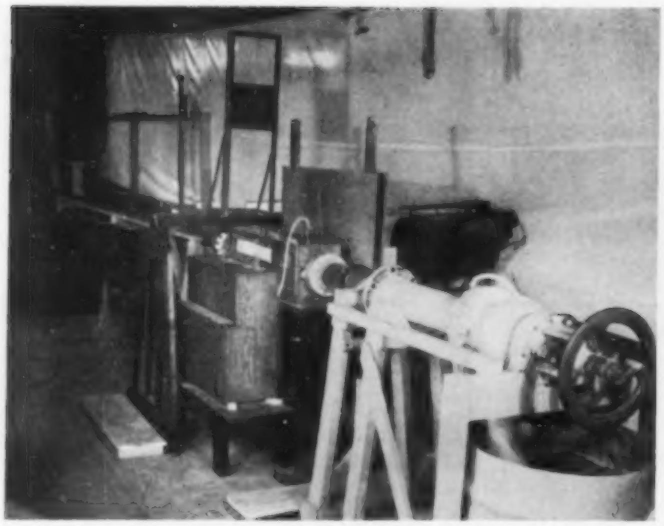
The committee has made some suggestions to G. E. Mussey at Rensselaer Polytechnic Institute, in connection with research on the flow of sewage through a Parshall flume.

Manual of Hydraulic Laboratory Practice

Drafts of the four sections of the proposed manual, as previously outlined—(1) historical summary, (2) principles of similitude, (3) practical applications of the laws of similitude, and (4) construction and operation of models—are being prepared by members and submitted to Dr. L. G. Straub, who is acting as editor. The manual will be prepared in mimeographed form during 1938.

Abstracts of Translations

Under the leadership of a group of Freeman scholars, and with the cooperation of the committee and other interested engineers, nine abridged translations of for-



APPARATUS FOR STUDYING CONVERSION OF ENERGY

eign articles on hydraulics were prepared under the immediate supervision of D. P. Barnes, Assoc. M. Am. Soc. C.E., and published in PROCEEDINGS for November 1937.

LETTER SYMBOLS FOR USE IN HYDRAULIC LABORATORIES

A number of comments on the list of tentative symbols prepared by the committee and published in CIVIL ENGINEERING for January 1937, have been received. It has been recommended that the terms relating to density and viscosity should be more clearly defined, and that the dimensions of all symbols should be given, using the force-length-time system. Owing to the appointment by the American Standards Association of a new subcommittee on Symbols for Hydraulics, of which J. C. Stevens is chairman, final action regarding symbols was held up until 1938 in order to have them in accordance with the work of the new committee. In regard to the choice between the use of fractions or of integers to indicate scale ratios for tests of hydraulic models, a questionnaire is being sent to selected laboratories to guide the committee.

During 1937 Capt. H. D. Vogel, one of the founder members of the committee and its former secretary, found it necessary to resign. Lieut. Paul W. Thompson, director of the U. S. Waterways Experiment Station, Vicksburg, Miss., was appointed in his place. With this exception, the membership has remained unchanged:

Respectfully submitted,

J. C. STEVENS, *Chairman*

C. E. Bardsley	D. P. Barnes
E. W. Lane	F. T. Mavis
L. G. Straub	C. A. Mockmore
P. W. Thompson	M. P. O'Brien
Members	H. A. Thomas
	Cooperating Members

CHILTON A. WRIGHT, *Secretary*

Committee on Meteorological Data

ACTIVITIES of the Committee on Meteorological Data since its last progress report have been largely confined to efforts of individual members in connection with their affiliations with other organizations and agencies. The Society's committee is represented upon the Weather Bureau Committee of the Science Advisory Board, the Special Advisory Committee on Standards and Specifications for Hydrologic Data, Water Resources Committee of the National Resources Committee, and upon the Committee on Absorption and Transpiration, Section on Hydrology of the American Geophysical Union.

While the committee is listed as a research committee, it early found it impractical, due to cost, to engage in research work itself, and has directed its activities towards the stimulation of research by other agencies, and to maintaining contact with the U. S. Weather Bureau and like bodies engaged in meteorological research.

During the past few years considerable progress has been made in the development of material and information in those fields of meteorology which are of particular interest and use to engineers. Progress in the collection, compilation, analysis, interpretation, and publication of this type of data still leaves much to be desired, but the primary handicap is the lack of funds for prosecution of such work.

ACTIVITIES OF THE WEATHER BUREAU

The U. S. Weather Bureau established a Meteorological Research Division in 1936, and about 60 particular problems in various fields of meteorology are under current investigation. Important progress is being made in the development of a program of air mass analysis in its application to forecasting, and the evolving of effective and practical procedure for integrating such developments with the regular forecasting work of the bureau. A cooperative research project involving the bureau, the U. S. Geological Survey, and the state of Pennsylvania, which has for its objective the development of improved forecasting methods for the Allegheny, Monongehela, Susquehanna, and Delaware watersheds, has been established.

Work in the collection and publication of snowfall data and forecasting stream flow from such data is being extended. Research work on shielded snow gages is being carried on at Salt Lake City, Utah, and studies of evaporation from snow surfaces are being conducted in Yellowstone Park, Wyo.

A creditable start has been made in the matter of inspection of cooperative stations, about 1,200 such stations having been inspected during the fiscal year 1936–1937. Further, several hundred new cooperative stations have been installed during the same period at points where additional meteorological data were needed.

Nearly four years ago a policy was adopted of transferring observation work from city offices, where observations might be affected because of improper exposure, to airports. Such transfer has now been made in eight instances, and further cases are under consideration. Certain difficulties have arisen in connection with this policy, among them being the fact that changes have been necessary in the location of the instruments at the airports after they have first been established, that in some locations the climate at the airport is somewhat different from that at the city location, and that it is necessary to maintain observations at the original location for a considerable period in order to obtain a comparison between the two places.

About twenty new evaporation stations equipped with standard Weather Bureau pans have been established during the past two years, in cooperation with other agencies, four of these being located along the Great Lakes in cooperation with the U. S. Engineer Office, with a view to obtaining a correlation between evaporation from the Weather Bureau pan and from the surface of the Lakes. The Bureau has also secured descriptions of between 150 and 200 evaporation stations of the standard Weather Bureau and other types, and data from many of these is being collected.

Bulletin W has been revised through the year 1930, the tabulation of excessive rainfall now being published in accordance with the recommendations of the Committee on Hydrologic Data of the Water Resources Committee. The title of the publication heretofore known as the "Report of the Chief of the Weather Bureau" has been changed to "United States Meteorological Yearbook."

In connection with the work of the flood forecasting program, an organization is being set up providing for hydrologists in each important river basin in the country, whose duties will be to prepare and keep current systems for prompt collection of rainfall and river-stage data, study the requirements in overflow valleys for flood forecasts, perfect and keep up to date plans for satisfying these requirements, and coordinate the flood work of the Bureau with that of other agencies engaged in collateral activities. Two basins—the Missouri and upper Mississippi—have already been provided for, and the work will be expanded as soon as funds permit.

Numerous other research and service activities in fields of meteorology, beyond those generally utilized by engineers, are being initiated by the Weather Bureau, and current activities in such fields expanded.

COMMITTEE ON HYDROLOGIC DATA MAKES RECOMMENDATIONS

In 1935 the Committee on Hydrologic Data made a report which was published by the National Resources Committee, and which set up standards and specifications for the collection of hydrologic data, including precipitation, evaporation, stream flow, ground-water behavior, and quality of water. The various federal bureaus engaged in such activities are now putting into effect the recommendations of that committee, with the result that the quality of such data is being improved and its publication standardized.

In 1936 the same committee issued a second report outlining existing deficiencies in such data, and setting up a program for additional activities in the collection and publication of same, this program covering the entire country and having as its objective a well-rounded and balanced network of observational activities and the publication in current form of all previous data with notes relative to its quality, methods of collection, etc. Estimates of cost to the federal government and to cooperating agencies of carrying out this program in connection with precipitation (including snow surveys and evaporation) were $600,000 for federal activities and $39,000 for cooperating agencies during the first year, and $297,000 and $12,000, respectively, during succeeding years. The total program represented, in the opinion of the committee, the minimum in adequacy in view of the importance of such data. However, due to lack of necessary appropriations, only a small part of the program has been initiated.

At the present time the Committee on Hydrologic Data has in preparation a report covering existing deficiencies in research in the various branches of hydrology, and outlining a program of research activities of a national character in order to round out present knowledge on subjects in this field.

COOPERATION OF WEATHER BUREAU WITH SOCIETY'S COMMITTEE

While it can be generally stated that increased service on the part of the Weather Bureau to the engineering profession will depend to a great extent upon the availability of increased funds for expansion of the Bureau's activities, the Society's committee has experienced an attitude of fullest cooperation on the part of the chief of the Weather Bureau and of the Bureau's staff, a sympathetic understanding of the mutual interests of the Bureau and the engineering profession, and a sincere desire on the part of the Bureau to increase its service to the engineering profession as fast as available funds permit.

Respectfully submitted,

DONALD M. BAKER, *Chairman*

W. W. Horner	C. H. Lee
Chas. W. Kutz	J. B. Lippincott

Committee on Stresses in Railroad Track

THE Committee on Stresses in Railroad Track is continuing its work as in the past. The staff of engineers under the direction of the chairman are engaged in field, laboratory, and office work along a program similar to that reported in 1937, with funds furnished by the Association of American Railroads. In parts of May, June, July, and September tests were made on the track of the Pennsylvania Railroad at Elkton, Md., using elaborate instrumental equipment largely owned by the Pennsylvania Railroad to measure stresses in joint bars and rail under various locomotive speeds up to 90 miles an hour, together with some trial tests with rail having simulated batter and with loaded cars having flat spots on a wheel and out-of-round wheels. Summer observational tests were made on long stretches of welded rail on the Bessemer and Lake Erie Railroad at Pittsburgh, Pa., and on the Delaware and Hudson Railroad at Schenectady, N.Y. Observational tests on the Pennsylvania Railroad in Indiana and the Atchison, Topeka, and Santa Fe Railway in Illinois have been made on about 18 stretches of track having various types of joint bars—these tests, in cooperation with the Committee on Rail of the American Railway Engineering Association, will be continued. A number of instruments have been built to facilitate the observations.

As heretofore, the research is being financed by the Association of American Railroads, and reports are being made to the American Railway Engineering Association, the committee being a joint committee of the latter association and the Society.

Respectfully submitted,

ARTHUR N. TALBOT, *Chairman*

W. J. Burton	George W. Kittredge
W. C. Cushing	Paul M. La Bach
W. M. Dawley	G. J. Ray
C. W. Gennet, Jr.	A. F. Reichmann
H. E. Hale	H. R. Safford
J. B. Jenkins	F. E. Turneaure

J. E. Willoughby

Editor's Note: The report of another Research Committee—the Committee on Flood Protection Data—was published in "Proceedings" for February 1938.

National Resources Committee's Urbanism Study

By LADISLAS SEGOE

MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS
PLANNING CONSULTANT, CINCINNATI, OHIO

THE peculiar problems of the city have seldom received the attention they deserve. An outstanding exception, however, is the comprehensive "urbanism study" recently made by a subgroup of the National Resources Committee. Mr. Segoe, having served as director of the study, is especially qualified to present this compact review of its essential observations and conclusions. His original paper, of which this is an abstract, was given before the City Planning Division at the 1938 Annual Meeting.

Readers interested in pursuing the subject further are advised that the Urbanism Committee's report was published in full by the National Resources Committee in September 1937, under the title "Our Cities—Their Rôle in the National Economy" (87 pp., quarto, illustrated). It is obtainable from the Superintendent of Documents, Washington, D.C., at 50 cents a copy.

THE city has been a neglected child of our national family. Although it has been playing a dominant rôle in our national economy for several decades, the recent study by the Urbanism Committee of the National Resources Committee represents the first official inquiry on a comprehensive scale into urban life and problems.

This neglect, by government, of the urban segment of our national life, and the failure to recognize and to give proper attention to the special problems of the cities, led to, or increased, the difficulties in meeting their severe problems during the recent depression. Federal and state governments found themselves without the necessary facts about prevailing conditions, and lacked the understanding of problems characteristic of cities which were required for devising emergency measures adapted to coping with their difficulties. With rare exceptions the cities themselves were ill prepared with finances, plans, or administrative machinery, either to help themselves or to cooperate with the state or federal governments. The Urbanism Study has been undertaken as a first step in making up for the deficiency in knowledge so painfully brought home by the events of the past few years.

NATIONAL ASPECTS OF URBANIZATION

Since 1920, or shortly before, the majority of the people of the United States have been living in urban places. By 1930, almost one-third of them were living in the 93 cities of over 100,000, and nearly one-half were within the environs of those cities. The city is today not only the principal place of residence of our people, but the primary workshop of the nation, the heart and nerve center of our intellectual and cultural life, and the seat of our most important division of government.

Here, as in other industrial countries of the western world, a surplus of agricultural production, and the consequent releasing of a substantial part of the rural population, coupled with the development of transportation and modern sanitation, were the preconditions of industrial urbanization. If one is to understand the resulting national urban pattern, as well as the structure of the modern city, it is important to recognize that, with the exception of the quite recent development of electric power and the internal combustion engine, all forces which conditioned urbanization have operated cumulatively and progressively to promote concentration. Nor is there any indication of a major shift in direction of these trends. Improved highway facilities and the automobile have extended the range of choice in location for industries, communities, and people, but they are permissive rather than controlling factors.

Urbanization can be expected to continue even if the total population ceases to increase. Further diffusion of the population in these metropolitan areas may be expected, but not wholesale decentralization. The cities of declining population will continue to be mostly the smaller ones.

THE CITY AND ITS PROBLEMS

Most fundamental among the problems of our cities are the poverty and economic insecurity of so large a proportion of their population. It should be recognized that it will be almost impossible to solve many of the most serious urban problems until larger and more secure incomes can be brought to a larger segment of our urban population.

An equally serious problem is the biological suicide of our cities, especially the larger ones. Only three cities of over 100,000 had a reproduction index in 1930 high enough to maintain a stationary population; and this class of cities on the whole had one-fourth less children than necessary for a stable population.

Standards of health and safety in our cities are far from what they could and should be. Population densities are all too high in many sections, and large numbers of people are often housed in overcrowded, obsolete structures. Playgrounds and parks are far from being adequate. There are still too much smoke and dust, too many objectionable odors and waste of all sorts, too much unnecessary noise and too much ugliness—sapping resistance against disease and against the strains which urban living puts on the nervous system.

So, too, with crime, vice, and delinquency. Deep rooted as these may be in the defects of our economic and social system, much could be accomplished by more emphasis on preventive and curative treatment in place of punishment, by minimizing poverty and inequality, by providing a decent environment for low-income groups.

Shortcomings in the machinery of local urban government are a serious handicap in coping with some of these problems and with others to be mentioned later. Our great cities overflow township, county, state, and even national boundaries, but this fact is disregarded; no adequate political and governmental machinery has been provided or invented to meet the needs of this modern product of urbanization—the metropolitan region. One of the most serious consequences of this disorganization is the confusion of conflicting and overlapping taxation. As a result of this chaos, there is no defensible relationship between tax revenues and the functions and responsibilities of the several forms of government.

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As to the physical development of our cities, the following maladjustments seem to be characteristic in various degrees of most of them: Concentration and congestion of every sort (population, buildings, and traffic) and inadequate public facilities in the center; haphazard dispersion, unnecessary or premature subdivisions, and superfluous public facilities in the outskirts; a scramble of incompatible property uses everywhere, save in the more recently built-up areas; lack of public spaces for recreation and other socially desirable purposes, and an excess of unproductive privately owned land; lag in needed public improvements; despoiled waterfronts; unattractive general appearance, obsolescence, inconvenience, inefficiencies, and waste of material resources and human effort, public and private. It may be profitable to dwell briefly on some of the fundamental causes to which these maladjustments are due.

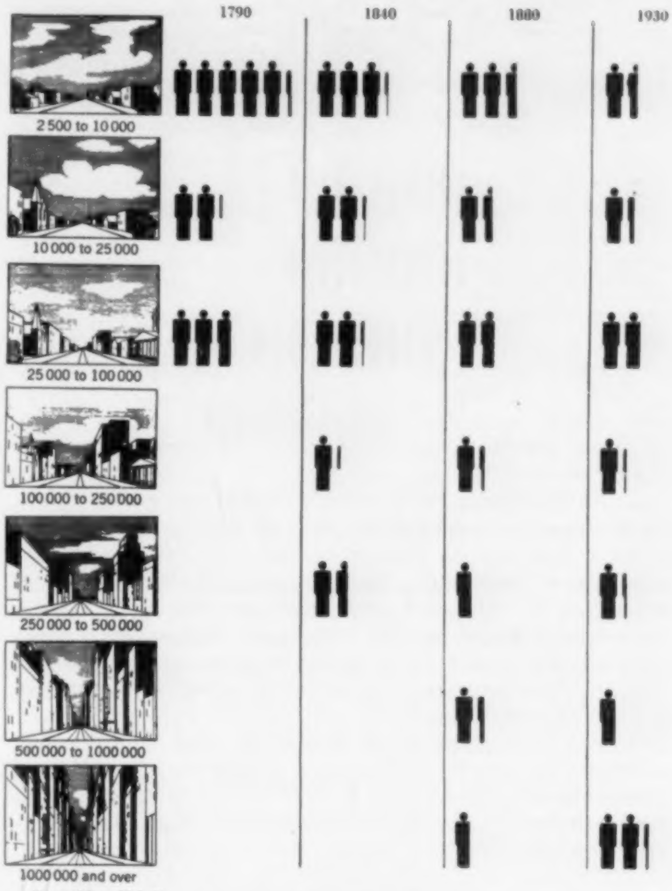
First among these causes is the extremely rapid rate at which urbanization has taken place and the even more spectacular growth of many of our cities, especially the larger ones. Still more damaging to orderly development was the ideology fostered by this rapid growth—the worshipping of bigness and the disregard of quality. In the race to advance their relative position in the census volumes, our cities not infrequently laid the foundations of many of their present difficulties. They built or helped to finance unnecessary competing transport facilities; they prematurely annexed outlying areas; and they competed for industry without discrimination, thus encouraging unsound industrial locations and the building of a weak and unstable industrial structure. The consequences of these unsound policies are reflected today in wide fluctuations in employment, low annual family incomes, handicapped industries, and heavy tax burdens.

Another of the by-products of rapid growth has been the orgy of speculation in urban land which it spurred. Cities that were fortunate enough to own much of their land originally sold their holdings in haste and at ridiculously low prices, only to buy some of them back later at exorbitant figures. These practices resulted in desultory attention to proper neighborhood and community development, and impeded the creation of lasting values.

Most of the defects in the physical development of our cities and many of their social and economic ills flow from these causes. It is generally accepted that misuse and over-intensive use of agricultural land lead to depletion of productivity and erosion, and in the long run to a low standard of living. But it has not been recognized that the same is true of urban land to an even greater degree. The zoning and subdivision regulations instituted a few years ago in many localities, although a great advance, are of very limited effectiveness, at best, for checking the abuses in urban land utilization.

An additional major reason for the physical maladjustments and deficiencies of cities is their characteristic basic structural form. The city grows by continuous accretion around the periphery. The streets and other public facilities and utilities, originally provided to serve a development of modest density and height, are no longer capable of handling the load thrown upon them by the immeasureably more intensive use of properties. Augmenting public facilities in these central areas is made extremely difficult and lags behind the need because of the enormous cost of acquiring land, the inadequate financial resources of local government, and the absence of legal powers or other obstacles to the use of advanced methods of financing improvements.

Finally, the absence of direction and control by public authority of the growth of our cities—the lack of planning—must be charged with the major responsibility for most of the abuses, dislocations, and maladjustments in our present urban environment. City planning was introduced too late and in too mild a manner to have



From "Our Cities"

Proportion of Urban Population in Cities of Various Sizes
Each Figure Represents 10 Per Cent

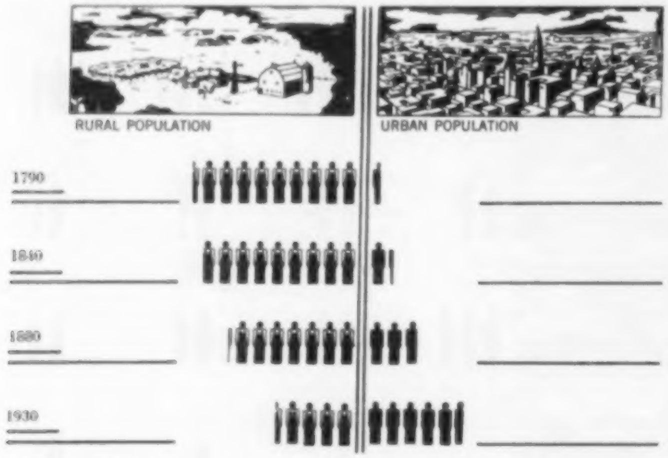
much influence on the basic structure and form of our cities. Even today, it is far from being as effective as it could be if adequately strengthened and extended.

To begin with, planning is handicapped now by the same limitations that obstruct the more effective functioning of local urban government itself. City planning bodies lack adequate legal powers; they have to struggle against uninformed public opinion and officials who do not appreciate the basic importance of community planning and its influence on community welfare. Planning suffers from niggardly appropriations and scarcity of competent personnel.

In order to be more effective, the sphere of city planning will have to be extended spatially and functionally and will have to be vested with legal powers commensurate with such expansion. Unless a county or regional planning agency exists, municipal planning bodies need to have jurisdiction over the entire area which has a bearing on the proper development of the community. They need to be given jurisdiction over all public improvements, not alone over those of their own municipal government, but of the county and any other local authorities, as well as over public works constructed by the agencies of the state or federal governments. In addition, their jurisdiction will have to be extended to the facilities of public utilities, such as transportation and transit lines and terminals.

Planning bodies ought to concern themselves with the

intelligent development of the industrial structure of the areas under their jurisdiction, with a view to enhancing its soundness and stability on which the future of their community will largely depend. They should



From "Our Cities"

PROPORTION OF RURAL AND URBAN POPULATION

Each Figure Represents 10 Per Cent of Total U. S. Population

also give more attention to minimizing the "technological tenuousness" of our cities, especially the great cities. The recent floods in the Ohio and Mississippi valleys demonstrated that the modern city is a delicate mechanism that can be paralyzed and demoralized by attack on a few vulnerable points.

Lastly, city planning, if it is to become a vital force, will have to gain for itself a place in the structure of local urban government where it will be closer to the local legislative body, the chief executive, and the administrative departments.

RECOMMENDED REMEDIES

Our cities, it is clear, are beset by a great variety of serious problems. But I am not going to propose that we abandon them and start building better ones of smaller size in new locations; that would be a dramatic but thoroughly unrealistic proposal. The findings of the Urbanism Committee did not shatter our confidence in the city or in the civilization it stands for. Provided only that a city has a sound economic foundation, or one that can be made sound—and most of our cities have—its defects, numerous as they may be, can be corrected in time. Space here permits only the bare mention of the more important of the general policies and lines of action recommended by the Urbanism Committee to this end:

1. Continued and intensified efforts by government, industry, and labor, towards the raising of family incomes and increasing the economic security of the urban worker.

2. Periodic appraisal by the federal government of the standards of life in urban communities and the extending of assistance, in cooperation with other governments and private enterprise, to substandard communities.

3. The revision of all national and local policies, public and private, in the light of the approaching stabilization of our population. Substitution of aspiration for quality in place of aspiration for bigness.

4. Equalization of economic and cultural opportunities between city and country.

5. Improvement and coordination of social welfare services by government on all levels in point of financing, methods and standards of administration, and personnel.

6. Modernizing legal procedures, more adequate attention to prevention, removal of restrictive administrative boundaries, and closer cooperation between local, state, and federal governments, in order to cope more effectively with crime; more adequate provision for recreation, better housing, and the eradication of slums, to combat delinquency.

7. Federal aid to states and local communities and other public and private agencies in providing recreation and cultural opportunities.

8. Attention by government on all levels to the problem of industrial location, in order to further the development of a more desirable national industrial pattern; to use more effectively each community's labor resources; to protect the community against the social costs of unsoundly located industries, and so forth.

9. A unified federal agency for the regulation of all forms of transport.

10. An inquiry into the possibility of coordinating all private and public power facilities.

11. The modernizing and enlargement of the powers and structure of urban government, with special attention to the problems of metropolitan areas.

12. Improving and facilitating collaboration between the cities and the federal government.

13. Raising the competance and prestige of the urban public service by improvement of personnel standards.

14. The making of a thoroughgoing study of the entire structure of taxation, to allocate revenue sources properly and to bring these into relation with the functions appropriate to each level of government.

RECOMMENDATIONS IN REGARD TO PLANNING

In regard to physical development, and planning in particular, the following are the major recommendations advanced by our committee:

1. An energetic and persistent drive to wipe out slums.

2. The formulation, adoption, and carrying out of a long-term national housing program, as a cooperative undertaking among federal, state, and local governments and private enterprise.

3. Increasing land ownership by municipalities in order to combat land speculation, better to control the development of the community and to make land available for housing, recreational facilities, and other needed public works.

4. The development and the keeping up-to-date by the federal government, in cooperation with state and local governments, of a nationwide, coordinated, long-range program of planned public works, in which effort the city, county, regional, state, and federal planning agencies should play a primary rôle.

5. Strengthening the authority and extending the scope of planning on all levels of government and in regional areas.

The Urbanism Committee does not claim that it has found the answer for every problem which it has uncovered. However, it should be evident, even from this partial recounting of the more important recommendations of the committee, that it has produced a long-term program. Many of these recommendations the city cannot hope to carry out alone—nor can all of them be successfully carried out by government on any level, without the earnest cooperative efforts of forward-looking private enterprises. That such cooperation will be forthcoming can hardly be doubted. For it must seem obvious to any thinking person that in the long run, the standard of material and cultural existence of the nation itself will largely depend upon our success in solving the problems of our cities.

Reports of Technical Division Committees

Executive Committee of the Power Division

On January 20, 1938, the retiring chairman of the Executive Committee of the Power Division, James W. Rickey, presented his report on the Division's activities for the year 1937. This report is here given in abstract form.

In line with the changing general attitude as to the importance of power, and in particular the extreme emphasis that is being placed recently on the part which power is taking in the economic and social development of the country, the policy of the Power Division is gradually changing. The nearly exclusive field of activity in the past was the purely technical aspects of hydro developments. Lately the economic problems became of such importance that they could not be neglected.

Such change in activity is also brought about indirectly by the proposed organization of a new Hydraulic Division of the Society. This Division, if approved by the Board of Direction, will take care of a part of technical activities which in the past was considered within the scope of the Power Division.

The general policies and the activities of the Power Division were discussed at the 1937 Annual Meeting in New York. This resulted in the appointment of the following committees:

1. Committee on Power Cost
   a) Subcommittee on Power Plant Depreciation and Obsolescence
   b) Subcommittee on Valuation of Power Plants
2. Committee on Progress in Power Plant Design
   a) Subcommittee on Progress in Prime Mover Design and Efficiency

In addition, to assure proper cooperation with other engineering societies, the following appointments were made:

a) Two Power Division members were appointed to the American Society of Mechanical Engineers Committee on Water Hammer
b) One Power Division member was appointed to the American Society of Mechanical Engineers Committee on Prime Mover

ECONOMIC PHASES OF THE POWER PROBLEM

The first attempt to bring the economic phases of energy generation into proper relation with the engineering problems was made during the October 1936 meeting in Pittsburgh, when a Symposium on Economic Aspects of Energy Generation was held jointly by the Power and the Engineering-Economics and Finance Divisions. Continuing this policy, the Power Division, through its Committee on Power Cost, has arranged a symposium on "Cost of Power" for the January 20, 1938, meeting.

The Pittsburgh (first) symposium covered the ground in so far as general principles are concerned. It is expected that the (second) symposium on "Cost of Power" will be a logical continuation, but with particular emphasis on factual data. The Power Division is contemplating a third symposium on the "Ultimate Cost of Power to the Consumer," which should consider, among other problems, the distribution problem. Therefore the main purpose of the second symposium was to consider the cost of delivered energy, say, on the high tension bus of the distribution substation.

An important step in clarifying the power situation would be to bring before an engineering audience the viewpoints of engineers connected with different branches of the federal government. Therefore, in selecting authors and discussers particular effort was made to have prominent government engineers present some of the papers or take part in the discussions. The third symposium is proposed for the Annual Meeting of the Society in January 1939. The desire is to develop a series of properly balanced symposia of considerable interest and to present papers and discussions of such importance that they could be used in the future in formulating definite conclusions and perhaps even recommendations.

As a professional society we have no political aspirations nor do we express any preferences. The symposia are not developed with the idea of supporting any particular interests or any particular political fad. Our object is to develop in an expert and unbiased manner the engineering and economic phases of the power problem.

When extending invitations to present and discuss these problems, effort should be made to select highly qualified engineers and economists, but who represent different points of view. The criterion should be that every invited author and every invited discusser is an acknowledged authority in his field.

By unbiased arrangement of our symposia, and by keeping them on the high plane of knowledge and experience, the Power Division will perform a real service to the Society, to the profession at large, and to the country in general.

SUGGESTED FUTURE ACTIVITY OF THE DIVISION

The Committee on Progress in Power Plant Design is planning to arrange a symposium during the 1938 Fall Meeting of the Society in Rochester, N. Y. Invitations should be extended to other engineering societies to participate in this symposium, making it possible to cover all important angles of the problem.

It would seem that it would serve best the purpose of the Division if the activities of the committees are fostered and facilitated. The Executive Committee should take over the general guidance of the work, giving as much leeway as possible to the activities of its committees.

It is hoped that by arranging a number of consecutive symposia, and as the result of the appointments of the different committees, the continuity of the Power Division policy will be preserved and its usefulness to members of our Society and the profession in general enhanced.

Report of Committee on Fundamentals Controlling Structural Design

On January 19, 1938, A. V. Karpov, chairman of the Committee on Fundamentals Controlling Structural Design, of the Structural Division, presented his report, which is here given in abstract form.

The committee is continuing the work of the former Committee on Practical Application of Modern Stress Theories and Fatigue Research. Its purpose is to review fundamental concepts involved in the design of metallic structures such as variation in the properties of metals, causes and significance of localized stresses, secondary and participating stresses, impact, fatigue, occasional overstress, and consideration of sources of stress and of types and methods of application of loads.

It was considered desirable that the Structural Division should bring to the attention of the members advances in theory and design. Such increased activity would necessitate a subdivision of the proposed work so that it could be carried on simultaneously by a number of subcommittees.

SUBCOMMITTEE 1 ON SURVEY OF STRUCTURAL RESEARCH

It was suggested that the committee act as a clearing agency, collecting the data that may be forthcoming from the different industrial and college laboratories. This suggestion was circulated among the members of the committee and met with general approval.

Acting along the lines of the suggestions received from members of the committee, a number of steps were taken preliminary to the appointment of the Subcommittee on Structural Research. It was thought that the majority of the colleges will be willing to cooperate with the committee. The cooperation of industrial organizations was by no means assured. Therefore, Leon S. Moisseiff and your chairman visited R. E. Zimmerman, vice-president in charge of research of the United States Steel Corporation. C. F. Goodrich assisted considerably in this matter by a previous talk with Mr. Zimmerman. The results of this visit were very satisfactory and a cooperation was assured. Mr. Zimmerman appointed H. D. Hussey to act as a liaison officer between the corporation and our committee. In appointing members of the subcommittee, attention was paid to geographical districts.

At present the Subcommittee on Structural Research is considering uniform procedure that should be followed by members. The extent of desired information and the effect which an attempt to collect detailed information may have on various investigators and research workers, also the possibility of assistance in publication of meritorious research papers, are being discussed.

SUBCOMMITTEE 2 ON DESIGN STRESS IN RELATION TO ULTIMATE STRENGTH, YIELD POINT STRENGTH, AND RELATED PHYSICAL PROPERTIES OF METALS

This subcommittee was organized at the suggestion of H. D. Hussey, who was made chairman. The subcommittee has devoted itself to a review of the work done by other organizations, in particular the American Society for Testing Materials, and the Royal Institute of Engineers of the Netherlands. The program for the forthcoming year includes in particular the following problems:

1. The effect of repeated stress upon the yield point as ordinarily understood.
2. The study of the interrelation of failure-producing stresses and the ultimate strength, yield point, etc.

SUBCOMMITTEE 3 ON EFFECT OF FATIGUE, CREEP, IMPACT, CORROSION, AND WELDING PROPERTIES ON DESIGN STRESSES

This subcommittee, which was organized recently under Prof. Hardy Cross's chairmanship, will attempt to review from the structural engineer's viewpoint, the subjects indicated in its title. At present there seems to be a considerable misunderstanding of the relative importance of these subjects and an absence of recognized terms. The developing of a certain system and order in these subjects should be beneficial. The subcommittee will engage in the preparatory work necessary for clarification.

SUBCOMMITTEE 4 ON DESIGN OF STRUCTURAL JOINTS

This subcommittee, under Prof. Wilbur M. Wilson's chairmanship, met in Chicago on October 8, 1937, and decided to concentrate on the effective net sections of tension members. Information available in technical publications relative to this subject is being collected and studied in connection with the fatigue tests of riveted structural members that are being concluded at the University of Illinois. It is hoped that when all of this material has been properly digested, the subcommittee will be able to formulate an expression for the allowable net section which will prove to be acceptable.

SUBCOMMITTEE 5 ON LIGHT-WEIGHT STRUCTURAL DESIGN

This subcommittee was organized under Leon S. Moisseiff's chairmanship. In accordance with the function of the main committee to follow and stimulate the progress of the study of materials and their most effective use, this subcommittee will start its work with the discussion of: (1) The moduli of elasticity of light-weight alloys; (2) their effect on the stability of members of structures; (3) efficient methods of stiffening; (4) effect of low moduli on end connections of members; (5) study of behavior of riveted and welded connections.

ACTIVITIES OF MAIN COMMITTEE

The work being subdivided between a number of subcommittees, the important duty of the main committee is to coordinate these activities and to prevent overlapping and interference between the various subcommittees.

It was thought that the work of the committee would be facilitated if its activity were brought to the attention of interested circles. The chairman therefore took part in the Conferences on Fatigue and Creep of Metals that were held in July 1937 at the Massachusetts Institute of Technology and delivered a paper entitled "Fatigue Problems in Structural Design." The papers presented at the conferences are expected to appear in the form of a booklet to be published by the American Society of Mechanical Engineers during the spring of 1938.

Consideration is being given to the advisability of publishing, from time to time, the results of the work of the various subcommittees and of arranging a symposium on a subject of general interest to Division members.

Committee on Technical Aspects of Refuse Disposal

THIS THIRD annual report of the Committee on Technical Aspects of Refuse Disposal will be confined to an account of refuse-disposal developments during the past year. The first report of the committee contained definitions of refuse materials and a statement of the status of refuse disposal in the United States and in Europe. The second report presented a year ago outlined some of the developments in the field in the past and pointed out some items which could be improved or further developed. Both preceding reports were published in CIVIL ENGINEERING, for March 1936 and March 1937, respectively.

Of the incinerators which have been under design or construction during 1937, two of the most notable are in New York City—on 56th Street in the Borough of Manhattan, and in Flushing in the Borough of Queens. These plants were designed by New York's Department of Sanitation, and as was the case with all the large plants built in 1937, were financed with PWA assistance. The 56th Street plant has a rated capacity of 750 tons of mixed refuse per 24 hours, and includes a power plant with waste-heat boilers and turbo-generators. The building housing the plant includes also a large garage and two section stations for the department, with the borough-headquarters building adjoining. Provision has been made for a large future waste-heat power plant, in addition to the one now installed, for supplying steam or

electric power nearby. There are a number of interesting features of design in the incinerator, including electrically operated charging gates, hydraulically operated ash gates, crane hoists of very high speed, air-cooled refractory walls, provisions for cremating many carcasses of large animals, and a special flue layout intended to prevent fine ash from reaching the chimney.

The city of Detroit received bids early in the year for four plants for burning mixed refuse, aggregating in capacity 1,400 tons per 24 hours, the lowest base bid for the four plants being $1,392,000. The largest plant is expected to be ready for use in a few weeks, when the existing garbage-reduction contract expires.

The city of Pittsburgh again has received bids, this time for one plant having a capacity for burning 900 tons of mixed refuse per 24 hours. The award of the contract is in litigation at this writing. In connection with this plant, bids were received on various bases, covering different sizes of plant, including and excluding operation as well as construction, and also including bids for collection. The proposed operating and collecting contracts included a bid price per capita per year, with a stated population for the first year, adjusted annually thereafter in accordance with a stated factor applied to the number of enrolled school children. Stipulations were also made as to wage rates for operating forces, with relation to prevailing rates of similar labor classifications.

In another month Rochester, N.Y., will have completed the construction of its new plant for the incineration of the city's rubbish, including a waste-heat boiler plant to supply steam for operating the adjacent garbage-reduction plant. These boilers will use for feedwater the hot condensing water from the reduction plant. The furnaces have thin air-cooled refractory walls, and the boiler settings have water-tubed walls above the lower level. The boilers are designed for the higher pressure required for possible future sales of steam to nearby public utilities or industrial plants, but will operate at 115 lb per sq in. while furnishing steam to the reduction plant.

The city of Manchester, N.H., has recently placed in operation its 150-ton incinerator. This plant, which cost about $137,000, includes a waste-heat boiler plant, supplying the steam for heating the building, for operating the induced-draft fan turbines and certain other auxiliaries, and for operating the adjacent asphalt plant.

The city of Los Angeles, Calif., is about to advertise for bids on a contract for construction and 10-year operation of a 480-ton plant for burning rubbish. Mr. Cortelyou reports that this plant will have revolving furnaces, largely automatic in operation, which are expected to reduce the labor cost materially. The rubbish is to be dumped from trucks into large hoppers, which will feed by automatic hydraulic rams into the upper end of the furnace. These furnaces are steel-jacketed and are in the shape of the frustum of a cone. They are lined with fire-brick and revolve slowly, providing a period of about one hour for the passing of the rubbish through the furnace. The flue gases will pass upward into a separate combustion chamber and thence through a water-spray scrubber to a low chimney. Ashes are to be discharged on to a metal conveyor with a magnetic pulley for removing the ferrous metals. Large combustible objects not entirely consumed in the one-hour period of passing through the revolving furnace, are to be burned in a secondary revolving furnace. Automatic draft controls are to be provided to maintain a temperature of 1,500 F in the combustion chamber. During the past year, with a local steel works cooperating, the city has built a single unit of this type of furnace of 24-ton capacity, and has tested it for three weeks with various classes of rubbish and various mixtures of garbage and rubbish, reporting satisfactory results.

In addition to the Detroit, Manchester, Rochester, and New York City plants already mentioned, the Public Works Administration reports several municipal refuse-incinerator projects on which work was in progress during 1937. These comprise a New York City plant at Maspeth, with a capacity of 200 tons per 24 hours, and 50-ton additions to the Betts Avenue and Bergen Landing plants; a plant at Charleston, W.Va., with a capacity of 200 tons per 24 hours; the Oyster Bay, N.Y., plant, having a capacity of 150 tons per 24 hours; a 45-ton plant at Gaffney, S.C.; and a 35-ton plant at Ada, Okla. The total cost of the five New York City projects is about $4,000,000.

Several incinerators have been under construction during the past year with WPA labor, the principal ones being in Danville, Hazard, Owensboro, and Paintsville, Ky.; Highland Park, Mich.; Tenafly, N.J.; and Kenosha, Wis. The last-named is now in operation.

Other plants under construction in 1937 are those at Frederick, Md., with a capacity of 60 tons, for burning refuse mixed with sludge from the adjacent sewage-treatment plant, delivered on the charging floor by conveyors; a similar plant at Winfield, Kans., of 30-ton capacity; an 80-ton incinerator for burning mixed refuse at Haverford, Pa.; a refuse incinerator at Middletown, Conn., with a present rated capacity of 40 tons per 24 hours, and provision for doubling the capacity in the future; a 24-ton refuse incinerator at Raritan, N.J.; a 30-ton refuse incinerator at Albemarle, N.C.; a 20-ton plant at Greenhills, Ohio; and a 36-ton plant for mixed refuse at Ilion, N.Y.

The Ilion plant, which is now under construction by WPA labor, is adjacent to a separate sludge-digestion sewage-treatment plant and includes provisions for heating water for warming the digestion tanks and for burning sludge gas and screenings in the incinerator. It is understood that the gas produced over weekends and during the 18 hours daily when the incinerator will be inactive, will be stored and used in the 6 hours of incinerator operation; also that it is proposed to dump the wet sewage-screenings into the incinerator at the end of the day's operations, for drying during the night.

TREATING GROUND GARBAGE WITH SEWAGE

Further experimental progress has been reported during 1937 in the treating of ground garbage with sewage. A number of laboratories have now made studies, with reported favorable results, of the digestibility of mixtures of sewage and garbage, treatment of such mixtures in Imhoff tanks and septic tanks, the settleability of the mixture, the ability of chemical precipitation methods to clarify such wastes, their ability to be dewatered, and also to be oxidized.

The city of Lansing, Mich., is completing the construction of a new sewage-disposal plant which includes equipment for the grinding of garbage and the delivering of the ground garbage to the sludge digesters. After digestion, the sludge and garbage are to be dewatered on a vacuum filter and then discharged into a multiple-hearth incinerator.

Studies have been made at Flint, Mich., looking towards an addition to the present sewage-treatment plant to handle garbage mixed with the sewage. It has been reported that the method is being considered of grinding the garbage and discharging it into the sewer system at grinding stations located in different parts of the city.

The method of grinding garbage at central stations,

NEW YORK CITY'S 56TH STREET INCINERATOR

from which the ground garbage is discharged into sewers, has continued in operation at St. Louis, Mo.

With reference to household garbage-grinders, it is stated that several thousand units are in service in over 200 cities in the United States. It is of interest to note that the cities of Los Angeles, Calif., and Riverhead, N.Y., have passed ordinances to the effect that the discharge of unground garbage into sewers is not permitted, but that such discharge of properly ground garbage is permitted. Another year's experience appears to substantiate the statement in last year's report of this committee, to the effect that (at least for a long time) the number of household grinders installed will not, on the whole, greatly affect the operation of sewerage systems.

Spot prices for garbage grease rose steadily from the low in the latter part of 1932 until the latter part of 1937. During most of 1937 the grease from some reduction plants has brought the most favorable prices in 10 years. However, since reaching the peak, grease prices have fallen rapidly, in some cases to a figure of about $3 per cwt.

It is not known that any new reduction plants have been constructed this year, nor that any have gone out of service. In Detroit, the contract will expire in a few weeks, and it is expected that reduction in Detroit will stop at that time, in view of the fact that the largest of the city's four incinerators now under construction will then probably be ready for operation.

The principal development of interest in connection with hog feeding of garbage during the last year has been the drastic reduction in hog prices, which in Chicago fell from a high of around 13½ cents during this last summer to a low of between 8 and 8½ cents, which has been current for the last few months.

DEVELOPMENTS IN COLLECTION VEHICLES

In connection with the collection of refuse, there have been some developments recently in the design of collection trucks, especially as regards enclosure of bodies, mechanized loading, and reduction of loading heights. Many of these experimental features are similar to devices in use abroad, particularly in Germany.

An example of one type of garbage-truck design is seen in those recently placed in service in Racine, Wis., where an enclosed body of watertight, welded, high-carbon steel plate construction is loaded by depositing the garbage in a bucket in the rear at a convenient height above the ground, the bucket being hoisted hydraulically and dumped automatically into the body, which has a capacity of 8 cu yd.

The city of Rochester, N.Y., has during 1937 purchased new 8-cu yd and 14-cu yd rubbish and ash trucks, which are described as being provided with removable side boards, and which have a low loading-height, accomplished through a special design of hydraulic hoist. The tail-gate is operated hydraulically, and the bodies are enclosed, with folding-back tarpaulin covers.

Both Buffalo and Rochester have devised a means of maintaining a convenient loading-height by providing a comparatively low enclosure at the front, with the rest of the enclosure higher. From time to time the materials are elevated and transferred to the back of the truck by raising the body, but leaving the tail-gate closed.

One new model of truck has been brought out, having a capacity of 3 cu yd, with straight sides about 15 in. high, but equipped in addition with removable flared sides extending the height another 10 in., with sliding covers arching between the tops of the flared sides, thus increasing the capacity to 6 cu yd. The covers are in three sections on each side, each section opening over to the other side. Dumping is at the end, the cover being provided with a top-hinged tail-piece.

The New York City Department of Sanitation has designed and put into service 12-cu yd and 24-cu yd trucks with closed steel bodies, loaded through two steel doors on each side, and through the top. For snow loading, the entire roof panel is removed.

A more recent type designed by that department, however, has totally enclosed bodies and is equipped with mechanical loaders, consisting of simple chain-conveyors carrying the material, which is deposited in a hopper 40 in. above the ground upon a 30-deg angle to the top of the body and along the top to the front, thus loading the body continuously towards the front. The chain travels at the rate of 660 ft per min. A door is provided on the side, at the front, for loading large objects. Dumping is by elevating the front hydraulically and raising the tail-gate. As is the case with other mechanically loaded trucks, only two men are required for loading operations.

Another new type of body, which has been announced and tried out in New York, consists of a 6-ft in diameter cylindrical tank about 15 ft long, with an impeller inside, operated by power from the truck engine. The impeller rotates and rams the refuse, crushing and compacting it to one-half or one-third of its normal volume, and exerting a possible pressure of 800 lb per sq ft. The mechanism may be set for any predetermined pressure, and when this is reached the power is automatically released. The cylindrical bodies are loaded through double-hinged counter-balanced doors, one on each side at the front end, providing a low loading-height. Periodically the doors are closed, and the impeller pushes the material to the rear and compacts it, this process occupying a total time for loading the truck of not over 20 minutes. About 12 cu yd of space is available for the compacted material, equivalent to about 30 cu yd of ordinary loose rubbish. The body is emptied at the rear end, without raising it, by means of the impeller, which pushes the refuse through the tail-gate as the gate swings upward. A platform is provided on the top of the body for unusual items too bulky to go through the doors.

Respectfully submitted,

HARRISON P. EDDY, JR., *Chairman*

Herman G. Baity — Walter N. Frickstad
Herman P. Cortelyou — Harry Goodridge
Frank E. DeMartini — Leon G. Williams
Frank C. Tolles

Editor's Note: The reports of three other Technical Division committees will be published in "Proceedings." Those of the Committee on Water Supply Engineering (Sanitary Engineering Division) and the Committee on Masonry and Reinforced Concrete (Structural Division) will appear in "Proceedings" for March 1938. The report on Fatigue Tests of Riveted Joints (Structural Division) will appear in a later issue of "Proceedings."

ENGINEERS' NOTEBOOK

From everyday experience engineers gather a store of knowledge on which they depend for growth as individuals and as a profession. This department, designed to contain ingenious suggestions and practical data from engineers both young and old, should prove helpful in the solution of many troublesome problems.

Street-Numbering System for Large Cities

By Richard R. Lyman, M. Am. Soc. C.E., 5 Gordon Square, London, W. C. 1, England
and A. Z. Richards, Jr., Salt Lake City, Utah, U.S.A.

The system of numbering streets and houses which is explained in this article is applicable to even the largest urban regions, and makes it possible for any traveler to find any address without a map or other help. It is now being installed in Salt Lake City, Itah, over an area comprising more than a dozen municipalities, and in the city of St. George, Utah. The system is also under consideration in other parts of the United States and in Europe, and certain features of it—notably the numbering of streets—have been adopted in Los Angeles, Calif., and Kansas City, Mo. Briefly, the plan is as follows.

All streets are to be regarded as either east-and-west, or north-and-south streets. At each intersection the signs bearing the names of the streets will be accompanied by numbers. These numbers will be the distances of the intersections north or south and east or west from reference lines which pass through some central point in the city. When the system is completely installed the proper number will accompany the street name on all street signs. After that no new sign containing the name of a street should be put in place without its proper street number. The theoretical layout of a part of a city whose streets are numbered according to this plan is shown in Fig. 1. To a larger scale, the details of seven streets of the same city are shown in Fig. 2.

In Fig. 1, the general plan of dividing the city into four parts is shown by the reference lines *AB* and *CD*, which intersect at 0. Lines *AB* and *EF* are a half-mile apart, as are also lines *CD* and *GH*. Using 1,000 house-numbers per mile, there will be 500 house-numbers between *CD* and *GH*, and 500 house-numbers between *AB* and *EF*. These house-numbers run east and west from *AB* and north and south from *CD*. The even numbers are on the right and the odd numbers on the left side of the street when the observer is facing the direction in which the numbers increase. From the house-numbers which fall within an intersection, those ending in 0 or 5 are generally selected to designate the street.

Street Signs Along Highland Drive, a Slightly Diagonal Street in Salt Lake County, Utah

The street numbers should be placed with the street names at all street intersections, so that a traveler at any intersection will know not only the name of any street but also its position in the city—its location with respect to the reference lines. At all street intersections in Fig. 1, signs are shown containing the numbers that are to accompany the street names at the various intersections.

Example: King Street, shown in the lower right-hand corner of Fig. 1, would have the sign "King St., 400 S" at its upper end, and the sign "King St., 475 S" at its lower end. A house-number sought on this street can be easily found after locating either of these signs. Suppose a traveler who is at the street sign with "10 N, 50 E" accompanying the street names, desires to reach the house whose number is "449 E" on "King St., 400 S." As he goes along the streets, he notices the readings on the signs. He knows the street he seeks runs east and west because the number on the street is "499 E," and the number "400 S" accompanying "King," the name of the street, tells him that the street is 400 house-numbers south of the reference line.

When he reaches the sign marked "100 S"

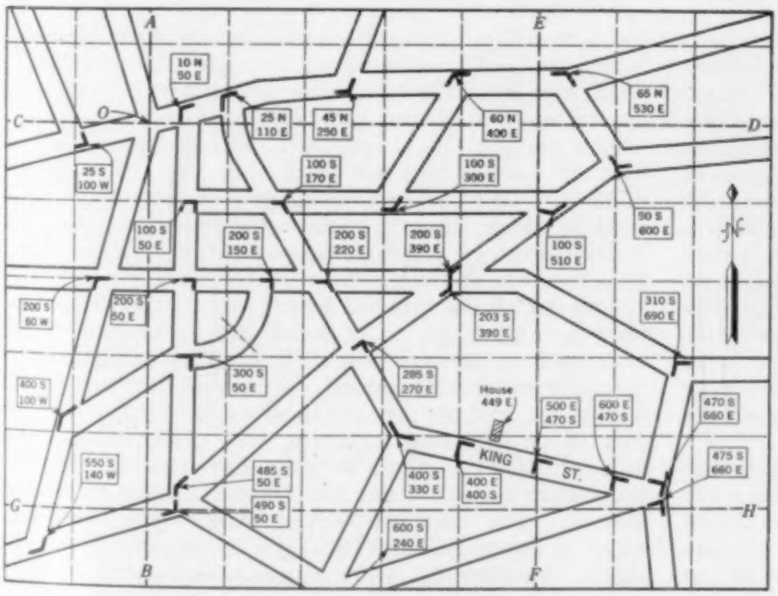


Fig. 1. Theoretical Layout of Part of City Numbering System

he knows he is going south, the right direction. He turns east, and when he reaches the sign "170 E" he is assured that his direction of travel is still correct although he must yet travel a considerable distance farther east. Continuing along the same street in a southeasterly direction he sees the signs "200 S," "285 S," and finally "400 S," which indicates that he has found King Street. The other number, "330 E," on the same sign indicates however that he must go farther east along King Street to find No. 449. All the signs at the intersections he has passed have made it clear that he was traveling in the proper direction.

The plan further provides that in densely populated or closely built up districts with long streets, signs may be placed not only at intersections, but also along the streets at such distances from each other that at least one street sign can be seen and easily read from any point in any street.

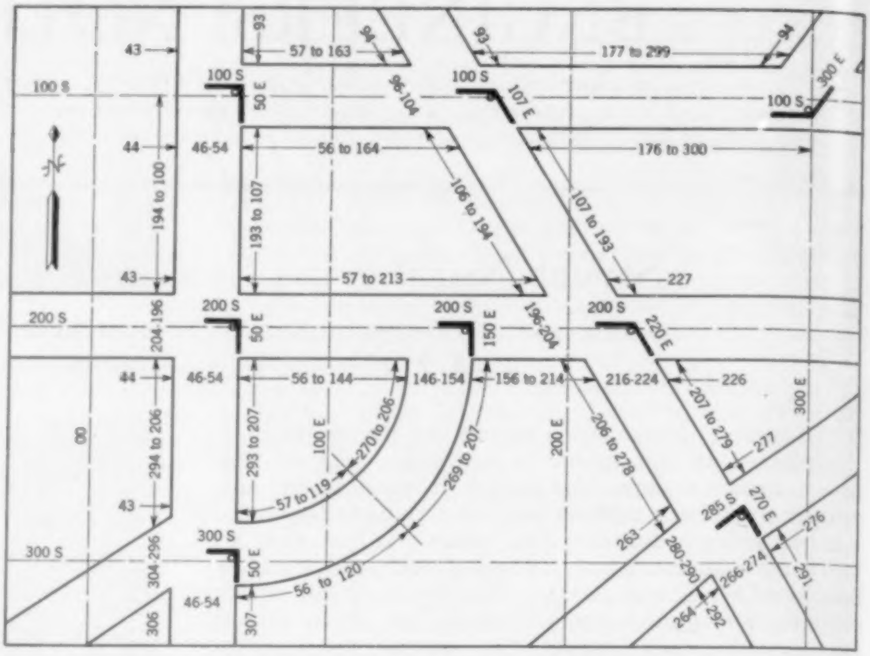


FIG. 2. ENLARGED DETAIL OF FIG. 1

Example: Examine again King Street running east from the street sign "330 E" in Fig. 1. The numbers available for houses on the north side of this street are 331, 333, ... 659; and on the south side, 332, 334, ... 658. In a sparsely settled district, and between street signs of fractional hundreds as "330 E" and "400 E," all three of these figures would be placed on a house, but in a densely populated district, and between signs of even hundreds, only the numbers 1, 3, ... 99 would be placed on the houses on one side of the street and 2, 4, ... 98 on the other. The even hundreds of these numbers—400, 500, and 600, for example—and the direction, with the name of the street, would appear only on the street signs. These numbers, as shown on King Street, are: "King St. 400 E"; "King St. 500 E"; and "King St. 600 E." While either "400 S" or "470 S" might appropriately accompany these signs, "400 S" is used for the west and "470 S" for the east portion of the street.

Street numbers make the locations of streets definite, and make it easy to find them, but it should be made clear that there is no need or thought of doing away with old and cherished names. Using this system, an address in London might be:

House—1072 N
Street—Tottenham Court Road, 420 W

Aluminum Mountings for Aerial Survey Mosaics

By JOHN P. KOCH, JUN. AM. SOC. C.E.
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ALUMINUM sheets are now used as a base for mounting aerial survey photographs in the Vicksburg District Office of the Corps of Engineers, U. S. Army. They have been found easier to handle, more durable, and more economical than the pressboard mountings they replaced. Tests show that they resist extremes of heat, cold, and moisture satisfactorily. The aluminum does not warp or cup, and edges are not easily damaged.

A 20-gage sheet has been used extensively on recent work, but it is believed that an 18-gage sheet might be somewhat more suitable. The aluminum is obtainable in either of two finishes; the gray seems to take glue slightly better than the bright. Of course, the same texture of glue that was used on the pressboard cannot be used on the metal; an adhesive of very high quality is required for good results.

Some difficulty has been encountered in putting the grids and control on the metal sheets. Scratching the lines with a steel point makes small ridges. Lines drawn with a 7-H pencil do not rub off easily, but they are dim. In circling the control points, the surface of the aluminum must be slightly roughened with an eraser to make the ink stick. It will be necessary to find an ink that will penetrate the metal before the control can be put on the aluminum sheets as easily as on pressboard. Otherwise a buffing treatment producing the same surface effect as the eraser will have to be developed.

In mounting the photographs, scotch tape is used to hold the prints in place until they are adjusted and marked. This has an advantage over the thumb tacks used on the pressboard, because the tape leaves no holes in the pictures; however, this operation requires about 20 per cent more time.

The size of the finished mosaic sheets used at Vicksburg is 27 by 40 in. The pressboard formerly used was obtainable in only one size (4 ft by 6 ft) and had to be carefully cut and trimmed. Counting the waste, the cost of material per finished sheet was about \$4.20. The cost of cutting and trimming was perhaps half that amount. On the other hand, the aluminum sheets, when ordered in quantity, can be obtained in the exact size desired. The cost of 20-gage sheets with machined edges is approximately \$0.45 per lb, or only \$1.52 per sheet. Further, 12 to 15 aluminum-mounted mosaics occupy about the same space as 4 pressboard sheets, which makes for considerable economy in filing.

Comprehensive Chart for Design of Concrete Members

By Jean M. Bayot, Assoc. M. Am. Soc. C.E.

Concrete Designer for the Venezuelan Government, Caracas, Venezuela

This article presents a chart (Fig. 1), which gives at a glance a clear picture of the effects on a rectangular concrete member of bending, compression, and tension, associated or separately. The chart also indicates the amount of tension and compression steel required to keep the concrete stress below or at a given limit, and the most economical combination of such reinforcement.

Let us consider, first, the general problem to be solved; next, the use of the chart in solutions; and, finally, the method of constructing similar charts for other values of n, f_s, and f_c, than those used here.

Assume that a member of breadth b and depth h (Fig. 2) is subjected to a thrust R of eccentricity e. In addition to this thrust there may or may not be other forces causing bending moments in the beam. It is required to determine the necessary reinforcement. Replace R by an equal thrust acting at the center line, and a couple Re. The maximum total moment, M, in the member is then equal to Re plus the maximum moment due to other causes, proper regard being given to sign. Compute R/bh and M/bh^2. These two values determine a point on the design chart, Fig. 1, R/bh being the ordinate and M/bh^2 the abscissa. From the position of this point, the nature of the required reinforcement is at once apparent (see "key chart," Fig. 3). Thus if the point falls in Zone 1, two reinforcements are required, one working in compression and one in tension. In Zone 2, two reinforcements are again required, but both are working in compression. In Zone 3, either one or two reinforcements may be required, working in tension. If the point is in Zone 4, the member theoretically needs no reinforcement.

For points in Zone 3, the amount of reinforcement is determined directly from the P and P' curves (or the P curves alone) passing through the point. In Zones 1 and 2, the solution is as follows (see Fig. 4): From the point, d, draw two lines, db and dc, one parallel to XX and the other parallel to YY. Then from any point of the base line (the heavy curved line marked 0.000) in the same zone, draw two other lines parallel to XX and YY, intersecting db and dc at b and c, respectively. At b and c, read the required percentages of reinforcement from the P and P' curves. By shifting point a along the base line (thus changing the position of the second set of parallels), it is easy to find the most economical reinforcement. The work is simplified by using a triangle drawn on transparent paper, which can be shifted about the chart. The sides of the triangle are parallel to XX, YY, and the vertical grid. The side parallel to YY must be extended, for use in Zone 2.

Construction of Chart

The curves of Fig. 1 are based on maximum stresses of 600 and 16,000 lb per sq in. for concrete and steel, respectively, with $n = 15$. The depth to reinforcement is $0.1\,h$. The following paragraphs explain the construction in general terms, so that similar charts can be prepared for other design stresses, values of n, and depths to steel.

From Fig. 2, $\dfrac{f_c}{v'} = \dfrac{f_s'}{n'(v' - 0.1h)} = \dfrac{f_s}{n(v - 0.1\,h)}$

$$\frac{f_s}{f_c} = n\left(0.9\,\frac{h}{v'} - 1\right) \qquad [1]$$

$$\frac{f_s'}{f_c} = n'\left(1 - 0.1\,\frac{h}{v'}\right) \qquad [2]$$

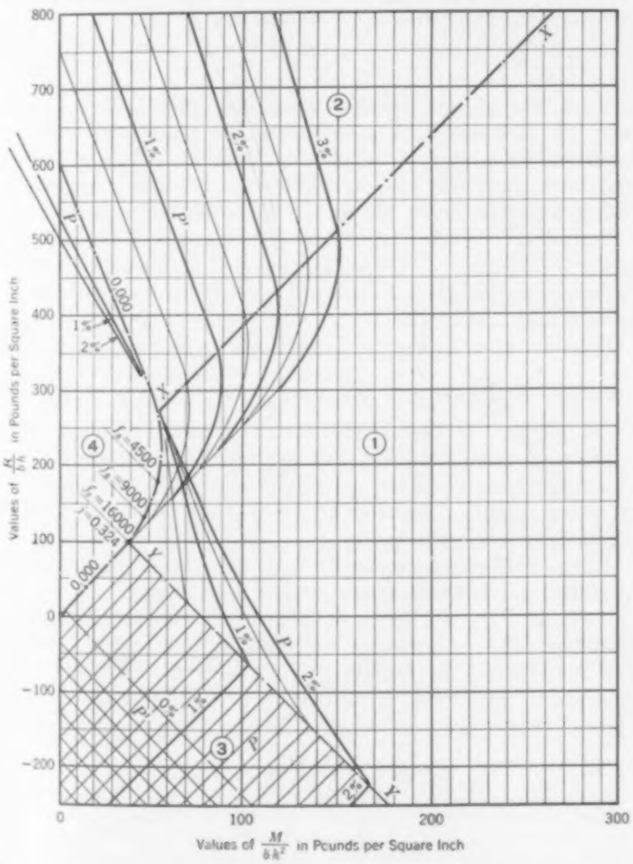


Fig. 1. Chart for Rectangular Concrete Members Subject to Bending and Direct Stress

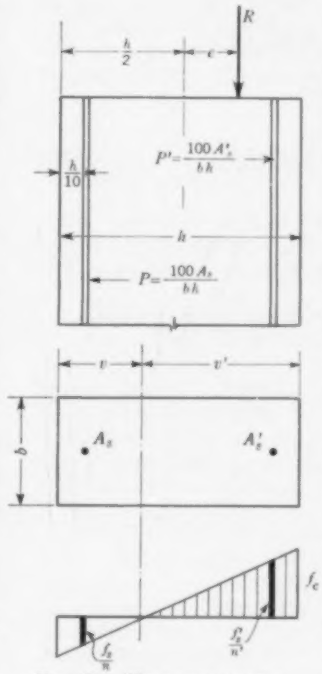


Fig. 2. Nomenclature

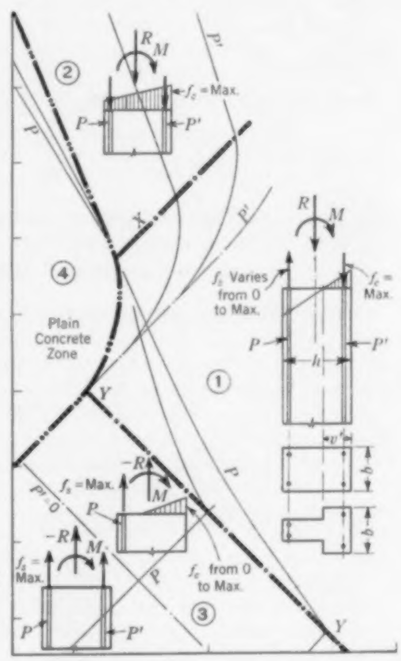


Fig. 3. Key Chart Showing Conditions in Zones 1–4

If there is no moment except that produced by R, $R = {}^1/_2 f_c bv' + A_s' f_s' - A_s f_s$. (This neglects the reduction of concrete section due to reinforcement.) Substituting values of f_s' and f_s from Eq. 1, and dividing by bh,

$$\frac{R}{bh} = f_c\left[\frac{v'}{2h} + \frac{n'P'}{100}\left(1 - 0.1\frac{h}{v'}\right) - \frac{nP}{100}\left(0.9\frac{h}{v'} - 1\right)\right] \quad [3]$$

Taking moments about the center of the section, substituting as before, and dividing by bh^2,

$$\frac{M}{bh^2} = f_c\left[\frac{v'}{2h}\left({}^1/_2 - \frac{v'}{3h}\right) + \frac{2n'P'}{500}\left(1 - 0.1\frac{h}{v'}\right) + \frac{2nP}{500}\left(0.9\frac{h}{v'} - 1\right)\right] \quad \ldots\ldots\ldots\ldots [4]$$

We have, also,

$$\frac{R}{bh} = \frac{f_c}{2}\left(\frac{v'}{h}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots [5]$$

$$\frac{M}{bh^2} = \frac{Re}{bh^2} = \frac{f_c v'}{2}\left(\frac{1}{2h} - \frac{v'}{3h^2}\right) \quad \ldots\ldots\ldots\ldots [6]$$

and since $R = \frac{f_c b}{2}\left(\frac{h}{2} - e\right)3$,

$$\left(\frac{R}{bh}\right)^2 = 0.75\, f_c \frac{R}{bh} - 1.5\, f_c \frac{M}{bh^2} \quad \ldots\ldots\ldots [7]$$

If in Eq. 7 we replace R/bh by its value from Eq. 5, we have $\frac{M}{bh^2} = 0.25\, f_c\left(\frac{v'}{h}\right) - \frac{f_c}{6}\left(\frac{v'}{h}\right)^2$, which is the same as Eq. 4 when $P = P' = 0$.

For the equilibrium of a plain concrete section (for eccentricities less than $h/6$),

$$\frac{R}{bh} = f_c - \frac{6M}{bh^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots [8]$$

In a section in which both reinforcements are in tension, $-R/bh = 0.01\ (f_s P + f_s' P')$ and $M/bh^2 = 0.04\,(f_s P - f_s' P')$. By adding these two equations we obtain

$$2.5\,\frac{M}{bh^2} = \frac{R}{bh} + 0.02\, f_s P \quad \ldots\ldots\ldots [9]$$

and by subtracting them,

$$2.5\,\frac{M}{bh^2} = -\frac{R}{bh} - 0.02\, f_s'\, P' \quad \ldots\ldots [10]$$

For a section subjected to bending and "pull," reinforced in tension only and with the reinforcement working at its maximum allowed stress while the concrete is compressed at various degrees, $v' = \frac{0.9\, f_c h}{f_c + f_s/n}$, and

$$\frac{R}{bh} = \frac{0.45\, f_c^2}{f_c + f_s/n} - \frac{f_{s\,max}\, P}{100} \quad \ldots\ldots\ldots [11]$$

$$\frac{M}{bh^2} = \frac{0.45\, f_c^2}{f_c + f_s/n}\left(\frac{1}{2} - \frac{0.3\, f_c}{f_c + f_s/n} + \frac{0.4\, f_{s\,max} P}{100}\right) \quad [12]$$

Setting $P = 0$ in Eqs. 11 and 12 and substituting,

$$\frac{M}{bh^2} = \frac{R}{bh}\left(\frac{1}{2} - \frac{0.3\, f_c}{f_c + f_s/n}\right) \quad \ldots\ldots\ldots [13]$$

To construct the chart, first lay out a set of coordinates in terms of R/bh and M/bh^2. Then Eq. 8 can be plotted to represent the 0.000 line from its top to a point a little above X; Eq. 7 is the same line, from that point to Y; and Eq. 13 describes the remainder of the line. In Zone 1, the ordinates of the P (and P') curves are given by Eq. 3, with P' (or P) taken as zero; and the corresponding abscissas are given by Eq. 4. Curves P and P' in the lower part of Zone 3 are given by Eqs. 9 and 10, and the P curves in the upper part of the same zone are obtained from Eqs. 11 (ordinates) and 12 (abscissas). Finally, the P and P' curves of Zone 2 are straight lines joining, respectively, the P and P' curves of Zone 3 (prolonged slightly into Zone 2) to points (R/bh, M/bh^2) found by the short-column formula for axial load with symmetrical reinforcement. Specifically, the two points determining each of these lines are found as follows:

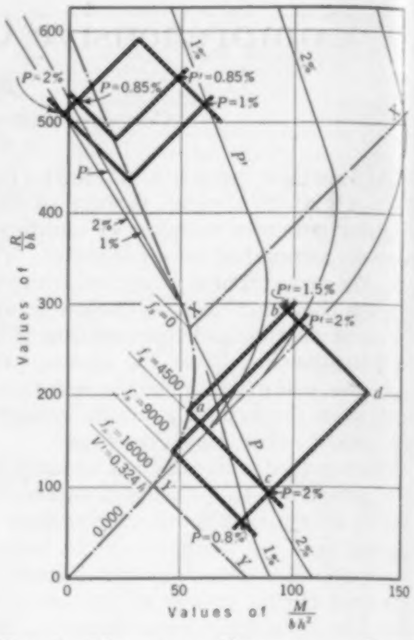


FIG. 4. METHOD OF SOLUTION IN ZONES 1 AND 2

1. From the lowest point on the 0.000 line given by Eq. 8, draw a line parallel to XX intersecting the prolonged P' curves of Zone 1, and a line parallel to YY intersecting the prolonged P curves of Zone 1. (This establishes one point on each of the P' and P curves of Zone 2.)

2. Compute the R/bh of a column with 1, 2, and 3 per cent of symmetrical reinforcement from the column formula, $R/bh = f_c + nf_c(P + P')/100$. Plot the values thus obtained (on the $M/bh^2 = 0$ ordinate), and draw parallelograms from these points with sides parallel to XX and YY and with their lower corners on the top of the 0.000 line. The two lateral corners of each of these parallelograms give a second point on one of the P curves and one of the P' curves, respectively.

Incidentally, in Fig. 1, Zone 2, the column formula was used in the form $\frac{R}{bh} = 0.3\, f_c'\left(1 + n\frac{P + P'}{100}\right)$, with $f_c' = 2{,}000$. If the coefficient of f_c' had been taken as 0.225 and the same method followed, we would have a chart agreeing with the Joint Committee's recommendations for members subject to axial load only, with a satisfying degree of continuity.

For a better understanding of the chart, let us study in detail a concrete section, $b = 10$ in. and $h = 10$ in., compressed by a thrust R with such an eccentricity, e, that the value of v' is 6 in. Four different reinforcements are considered in Table I, resulting in four different points on the chart, which have been plotted in Fig. 4. These points are the corners of the parallelogram *abcd*,

TABLE I. TYPICAL EXAMPLE

PERCENTAGE REINFORCEMENT		COMPUTED VALUE OF		PLOTTED IN FIG. 4 AS POINT	POINT FALLS ON
P	P'	R/bh	M/bh^2		
0	0	180	54	*a*	0.000 line
2	0	90	90	*c*	2% P curve
0	1.5	292.5	99	*b*	1.5 % P' curve
2	1.5	202.5	135	*d*	....

formed by parallels to XX and YY from d and a point of the base line corresponding to $v'/h = 0.6$, or to f_s = 4,500. (See Eq. 5 for relation between R/bh and v'/h.) The point on the base line shows the part taken by the concrete in the section's resistance; and sides ab and ac (or bd) represent the parts taken by P and P', respectively, the total resistance being shown at d.

Inspection of Eq. 3 shows that the term $f_c \; v'/2h$ represents the R/bh of the concrete alone; the second term, the R/bh of the compressive reinforcement; and the third term, that of the tensile reinforcement. The same relationships will be noted in Eq. 4 with respect to M/bh^2. The ordinate of any point on the chart is thus the sum of the R/bh of the concrete, the compressive reinforcement, and the tensile reinforcement; and the abscissa is the sum of the M/bh^2 of the same three items.

For designing beams for flexure only, it should be noted that the M/bh^2 values are on the $R/bh = 0$ ordinate, and that only where the YY line intersects that ordinate do the concrete and steel work at the design stresses at the same time.

By means of the equilibrium equations it is easy to construct a chart for conditions that would render a mathematical treatment altogether too complicated. For example, I have prepared such a chart for ultimate stresses of 2,000 and 36,000 lb per sq in. for concrete and steel, respectively, taking the strain-stress curve for concrete as a parabola followed by a flat portion equal in length to half the strain abscissa of the parabola, with a total maximum strain of 0.004, and avoiding the use of n by taking the steel stresses from the strains. A prestress of 11,000 lb per sq in. due to shrinkage of the concrete was considered to exist in the steel. These conditions are believed to represent fairly well the mechanism of flexure and direct stress at rupture, under ordinary climatic and practical conditions.

Our Readers Say—

In Comment on Papers, Society Affairs, and Related Professional Interests

Notable Bridges in Australia

DEAR SIR: Engineering works of novel design or construction in other parts of the world frequently miss being recorded in our own technical literature. Such has been the fate of two suspension bridges of unusual interest recently completed in Australia.

The Indoroopilly Bridge, which was formally opened by the governor on February 14, 1936, is the largest suspension bridge in Australia and the second longest span bridge on that continent, standing second only to the Sydney Harbor Bridge. It is located at Brisbane, spanning the Brisbane River at Indoroopilly. The main suspension span, which is 600 ft long, is of the type of suspension construction used in the Florianopolis Bridge. It is the fourth bridge of this type to be built, the second and third being the Point Pleasant and St. Mary's bridges over the Ohio River. The cables of the Indoroopilly Bridge are made up of the $2^3/_4$-in. wire ropes which were employed (128 at each corner) in the temporary anchorages during the construction of the Sydney Harbor Bridge. Each cable is made up of twelve of these wire ropes, arranged in four horizontal rows of three, spaced to give ready access for painting and inspection and for the insertion of the high-tensile steel clamping bolts, where the gusset plates of the top chord are secured to the cables. The towers are of concrete, and the cable saddles are supported on rollers enclosed in a steel box packed with grease. The steelwork of the main span is painted red. The excavations for the main tower and the anchorage on the Indoroopilly side were found to be gold bearing. The structure was built as a privately financed toll bridge to become public property when all interest and sinking fund charges have been made. I believe it is the first toll bridge in Australia. The volume of traffic and the financial returns to the investors have already exceeded expectations. The length of the structure is 1,305 ft plus 307 ft of new highway approach required. The total cost was approximately $425,000.

A suspension bridge over the Hastings River at Kindee Crossing, New South Wales, completed in 1937, is of the three-hinged, trussed-cable type, or inverted three-hinged arch. This form of braced cable construction was exemplified in Lindenthal's 1910 design for the Quebec Bridge, in a bridge over the Tiber at Rome (built in 1889), and in the side spans of the Tower Bridge at London. There are no examples in this country. The form is known as the Fidler truss, and is devised to make the equilibrium polygon pass near the center of the truss or between the two chords under all conditions of loading so that the stresses in both chords will always be tension. The system is statically determinate. Braced cables replace stiffening trusses at deck level.

In the Australian bridge just mentioned a novel feature is the use of wire ropes, instead of eye-bars, for the top and bottom chords of the braced cable. The trussed cable and suspenders are used in all three spans—220-ft main span and two 88-ft side spans. The cables are $6^1/_2$-in. plough-steel wire ropes of $^7/_{19}$ construction, and are protected against corrosion by asphaltic paint. The value of E is only 12,000,000. Gussets are securely clamped to the cable by means of grooved cast-iron packing pieces and fitted bolts, and diagonals and suspenders are secured to the gussets by pin joints. All diagonals are compression members of two angles riveted together to form a star section. Suspenders are tension members of round mild steel bar. The towers, deck, and wind bracing are of timber.

Both of these bridges apparently represent the influence of the Sydney Harbor Bridge competition of 1924. The Hastings River Bridge follows the design form submitted by the late Gustav Lindenthal, Hon. M. Am. Soc. C.E., and the Indoroopilly Bridge uses the design form submitted by Robinson and Steinman.

A medium is needed for making such information on remote engineering works available to American engineers, and the columns of CIVIL ENGINEERING might well provide this medium.

D. B. STEINMAN, M. Am. Soc. C.E.
Consulting Engineer

New York, N.Y.
February 9, 1938

Formula for Earth Pressures

TO THE EDITOR: Referring to the article, "Formula for Passive Earth Pressure," by Paul Andersen, Assoc. M. Am. Soc. C.E., in the January issue of CIVIL ENGINEERING, it is perhaps of interest to note that the active and passive earth pressures on inclined or vertical walls, with the surface of the soil horizontal or sloped downward or upward, can be expressed by a single formula. In this formula the coefficient expressing the various geometrical relationships is in both cases the same, differing only in sign.

Such an expression is found in the well-known treatise, *Erddruck, Erdwiderstand und Tragfähigkeit des Baugrundes* by H. Krey (fifth edition by J. Ehrenberg, Berlin, 1936), page 12. The coefficient is there tabulated at the end of the book for all possible conditions met in practice. The tables are very extensive and cover forty-two pages, of which nine are devoted exclusively to passive earth pressure.

A. FLORIS

Los Angeles, Calif.
January 20, 1938

Preliminary Investigations for Mackinac Straits Bridge

TO THE EDITOR: The excellent paper on "The Proposed Mackinac Straits Bridge," by James H. Cissel, M. Am. Soc. C.E., in the October issue, shows the urgent need of a program of education for the political officeholder in his and many other states. The most striking feature of the paper is the story of the apparent apathy of the state authorities towards anything approaching adequate financing of preliminary studies. Only $13,500 was made available for traffic surveys, borings and soundings, study of various locations, types of designs, span lengths, foundations, approaches, and other items.

After a traffic survey has shown the need for a bridge, the next step should be a comprehensive subsoil exploration, since the combination of superstructure and substructure cost must control decisions as to economy of design. Where foundation costs are high, span lengths must increase until the combination of superstructure and substructure cost reaches a minimum. Without adequate subsoil data, no comparison of different types of design and different location has any conclusive meaning. Furthermore, since variations from assumptions in subsoil conditions frequently have a controlling influence on ultimate cost, neither federal nor private agencies can be expected to assume obligations for the financing of an important structure until foundation conditions are determined.

Apparently only two borings were ever made, those on the direct route. Either route would require that at least the two main piers be founded in 180 ft of water, and for the direct route they would be located in the side walls of a deep canyon. No pier has ever been sunk in this depth of water and only one bridge (the Tacoma Narrows Bridge over Puget Sound), has ever been designed in anticipation of such a depth. The cost of these piers will increase rapidly, and the probability of safe installation will correspondingly decrease as the depth to which the caissons must be sunk below water bottom increases. The two borings show 30 and 40 ft of difficult sinking materials overlying the rock, and unforeseen difficulties and unfavorable geological conditions may obtain in the deep canyon; yet no borings, developed design type, or foundation analysis was made to justify an estimate of cost for these two piers. The same criticism applies to the other deep piers.

If the program for a bridge within the near future is abandoned, a total capital outlay of $6,500,000 is indicated for ferry service. Projecting to 1942, when a bridge might be put into operation, a traffic of 728,000 vehicles would appear conservative. In 1942, interest charges on $6,500,000 capital investment at 4 per cent will amount to $260,000. At an operating surplus (as at present) of $0.1325 per vehicle, $96,460 may be deducted from interest charges, leaving an annual deficit from the ferry system of $163,540, or $0.225 per vehicle, neglecting entirely deductions for a sinking fund.

Now if a bridge were to replace the ferries as of 1942, either the railroad should carry at least the proportion of cost by which the bridge cost is increased over that of a simple vehicular bridge without provision for railroad traffic, or the bridge should not provide for railroad traffic. Assuming the added cost for railroad traffic as one-third, the state's annual interest at 4 per cent on its share of a $30,000,000 bridge, or on the full cost of a $20,000,000 simple highway bridge, would amount to $800,000.

Assuming bridge-operating cost at 1 per cent of bridge-construction cost, and assuming bridge tolls the same as present ferry tolls, the balance sheet at the end of the first year of bridge operation would show:

Revenue:		
728,000 vehicles @ $1.77		$1,288,560
Costs:		
Interest on investment . . .	$800,000	
Operating costs	300,000	1,100,000
Profit		$ 188,560 ($0.235 per vehicle)

as against a deficit for ferry operation of $163,540, or $0.225 per vehicle, a difference in favor of the bridge of $0.46 per vehicle.

CARLTON S. PROCTOR, M. Am. Soc. C.E.
Consulting Engineer

New York, N.Y.
January 20, 1938

Factors in the Development of Recreational Areas

TO THE EDITOR: There is much valuable information for those directly concerned with proper planning in the article on "Recreational Planning for Urban Populations," by Justin R. Hartzog, M. Am. Soc. C.E., in the December issue.

Recreational activities may be divided into two general groups—the intensive, including various games such as baseball, football, and hockey, which may be enjoyed by large groups in a relatively small area; and the extensive, including hiking, camping, boating, and fishing, usually enjoyed by smaller groups or individuals and requiring large areas. For the most part intensive facilities seem to have been already fairly well developed in most of our metropolitan areas, while facilities for extensive recreation, often of more permanent value to the community, are as yet very meager.

Mr. Hartzog cites the Boston Metropolitan District Park System as an early example of a regional recreational scheme. Unfortunately, in many instances similar systems are almost impossible because of administrative difficulties. The Merrimack Valley in Massachusetts might be cited as an excellent example of such a case. Made up of 17 municipalities bordering the Merrimack from the New Hampshire line to the sea, this valley has a population of about 330,000 people. Because of the very heavy domestic and industrial wastes discharged, recreational use of the river is impossible, and the cities have been forced to look for other facilities.

In the case of the development of the new ocean beach at Salisbury, Mass., however, the situation is different, as the state is able to provide adequate facilities for the benefit of a group of communities which would not otherwise be able to afford them.

Mr. Hartzog states that recreational facilities in our metropolitan regions should never exceed a day's journey from home, but even this limit seems rather optimistic to me, since only those persons able to afford cars could possibly consider a one-day journey (involving usually a minimum of $5 even in the most economical car). This would almost entirely eliminate recreation for the masses when it is estimated that only one family in five has a car. A "closer-in" recreational region is necessary, and a more conservative estimate of the limiting radius would be 100 miles, but even this would be far too great in many instances.

The demand for extensive recreation, necessitating large open spaces located within 50 to 100 miles of great population centers, presents rather difficult land-use problems. In many of our major metropolitan districts the land within 100 miles of the area is already occupied with some other form of competing land use. Mr. Hartzog proposes the very ingenious expedient of leasing the various lands for hunting, fishing, camping, and similar recreations, until sufficiently large blocks of marginal or tax-exempt properties can be assembled for the development of permanent facilities.

Accessibility of site is an important factor in the development of recreational areas. In fact, the entire recreational plan may well be said to depend for its effectiveness upon a thoroughfare plan and transportation facilities. For example, the success of New England, with a recreational industry of almost half a billion dollars, is due in no small part to its excellent highways.

It is interesting to note that Mr. Hartzog considers the state parks to be the natural nuclei for the planning of extensive recreational facilities. This method of approach is peculiarly applicable to the state of Massachusetts, where we have directed our studies of extensive recreation with the idea of relating the state parks and reservations to the various metropolitan districts of the state.

In developing recreational systems, Mr. Hartzog believes that "We must care for the populace during weekends and vacation periods." To attempt to do this leads to very complicated situations, involving private interests and creating problems, which if correctly solved will be of benefit to private interests. It is easy to visualize well-cared-for state parks and reservations with adequate public recreational facilities, with regulated concessions for food, lodging, and camping privileges leased to private enterprise. Further, if adequate means of transportation were provided, benefits would nodoubt accrue to adjacent hotels also. Such cooperation between public and private enterprise seems to have unlimited possibilities.

ARTHUR W. DEAN, M. Am. Soc. C.E.
Chief Engineer, State Planning Board,
Commonwealth of Massachusetts

Boston, Mass.
February 3, 1938

Simplifying Engineering Formulas

TO THE EDITOR: In deriving the formula for the total negative and positive bending moment in a flat slab supported on column capitals, it has been customary to arrive at the result by a statical analysis of the problem, which gives as an answer

$$M_{total} = M_{pos} + M_{neg} = \frac{wL^2}{8}\left[1 - \frac{4c}{\pi L} + \frac{1}{3}\left(\frac{c}{L}\right)^2\right]$$

in which c = diameter of column capital; L = span center to center of columns; w = load per square foot; and W = total load $= wL^2$. This equation closely approximates $M = \frac{WL}{8}\left(1 - \frac{2c}{3L}\right)^2$, because the third term of the first equation is of small importance.

As the result of tests and other analyses the coefficient, $^1/_8$, or 0.125, has been arbitrarily changed to 72 per cent of this amount, or 0.09, in the formula specified by both the Society's Joint Committee and the American Concrete Institute.

I suggest that for all practical purposes, the equation $M = 0.09WL\left(1 - \frac{2c}{3L}\right)^2$ might just as well be written in a still simpler form. Ordinarily c is about $0.225L$ to $0.25L$; hence the quantity $\left(1 - \frac{2c}{3L}\right)^2$ varies between 0.722 and 0.694, thus making M vary between $0.065WL$ and $0.0625WL$—the latter of these coefficients being equal to $^1/_{16}$, the former closely approximating it.

Why not then conclude that $M = WL/16$ is sufficiently exact?

Naturally, this is a minor matter, inasmuch as it takes only a short time to get the value of M from tables or the regular formula. But writing the value of the coefficient of WL as a simple fraction immediately correlates it with that of other somewhat similar moment coefficients: for example, $+M = {}^1/_8\,WL$ for a simple beam uniformly loaded.

Also, $+M = {}^1/_{24}\,WL$, $-M = {}^1/_{12}\,WL$ for a fixed beam, uniformly loaded. This gives the total depth of the moment diagram as $^1/_{12} + {}^1/_{24} = {}^1/_8$.

Also, $-M = WL/8$ for a one end fixed, other end free beam, uniformly loaded.

Similarly, why not $M_{total} = {}^1/_{16}\,WL$ for a continuous slab on columns, for each direction, thus giving $^1/_8$ as the coefficient for both directions?

B. J. LAMBERT, M. Am. Soc. C.E.
Head of Civil Engineering Department,
State University of Iowa

Iowa City, Iowa
January 30, 1938

Port Planning and Development at Halifax

TO THE EDITOR: In his article on "Developments at the Port of Halifax," in the December issue, E. H. James outlines some excellent examples of comprehensive port planning and of really permanent works. These merit the study of American port authorities and engineers. Only too frequently, I fear, our port plans are non-existent and our port works based on expediency rather than permanency and sound engineering economics.

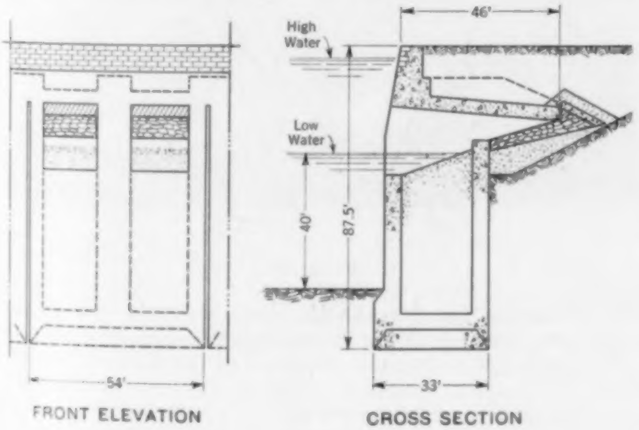


FIG. 1. DEEP-WATER QUAY WALL AT LE HAVRE

The wall and Pier A of the Ocean Terminals were constructed about twenty years ago. At that time I had the privilege of spending several months at Halifax and watching the progress of some of the work. The portion of these walls above low water is faced with granite, while the remainder is exposed to sea water. It would be interesting to know what type of cement was used in these cellular block structures and how well the exposed concrete has resisted the chemical action of sea water during this period.

From the description, it would appear that the construction of Pier B is somewhat similar in cross-section to Pier A but executed by different construction methods—namely, the use of cribs or floating caissons instead of cellular blocks. It will be interesting to study the durability of these cribs constructed with *ciment fondu*, the use of which must have greatly increased the cost. I should be interested in knowing whether consideration was given to the use of pozzuolanic cements (such as *ciment a la gaize*) with a high percentage of soluble silica. These have been successfully used in Europe and cost little more than normal cements.

The wood cribs for the wall at Richmond were sheathed with creosoted hard wood. It has usually been found difficult to treat hard wood satisfactorily with creosote. Because of this fact, the activity of limnoria, and the growing activity of teredo, one cannot help wondering how really permanent this crib work will prove to be.

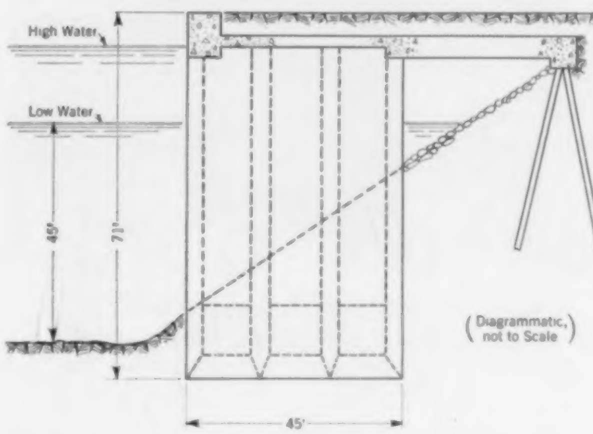


FIG. 2. DEEP-WATER QUAY WALL AT SOUTHAMPTON

It would be interesting to compare typical cross-sections of the structures Mr. James has described with two deep-water quay walls recently constructed in Europe—one at Le Havre with 25 ft of tide and the other at Southampton with 15 ft of tide, providing depths of 40 and 45 ft, respectively, at low tide.

The one at Le Havre, which may be called a counterpoise wall, consists of cellular concrete caissons, 54 by 33 ft, sunk to firm bearing in sand, combined with a continuous slab 46 ft wide, supported by beams cantilevered to the rear. The accompanying illustration (Fig. 1) indicates how this arrangement acts to reduce the earth pressure, provide drainage, and decrease the angle of the resultant to the vertical, thus permitting a base-height ratio of about 1:2.5.

The quay wall at Southampton, shown in Fig. 2, is entirely different in conception. This wall is composed of concrete caissons, 45 by 45 ft, sunk by dredging into sand, with only the rear cells filled with dredged material. To reduce the earth pressure a paved slope is carried up in the rear about to high water, and a concrete slab, bearing on the back of the caissons and a row of piles, carries the deck and eliminates any earth pressure due to superimposed load. In this case the base-height ratio is 1:1.6.

J. STUART CRANDALL, M. Am. Soc. C.E.
President and Chief Engineer,
Crandall Dry Dock Engineers

Cambridge, Mass.
January 24, 1938

SOCIETY AFFAIRS

Official and Semi-Official

Florida and Its First Society Meeting

Advanced Program Announced for Four-Day Joint Gathering, April 20–23, 1938

For a number of years the possibility has been visualized of arranging a Spring Meeting of the Society in Florida, but until this year conditions have not been sufficiently favorable. In April 1935 the Board of Direction evidenced its interest in Florida members by scheduling its regular meeting at Miami, to coincide with the sessions of the Florida Engineering Society. Now a similar cooperation, but on a larger scale, is planned for Jacksonville, April 20–23, 1938.

Fort Matanzas at St. Augustine, Fla.

Constructed in the Middle of the Eighteenth Century Without the King's Authorization but Described by Arredondo as "the Fond Object of Affection of Your Loyal Subjects"

On the two days preceding the meeting, the Board of Direction will hold its sessions and then, starting Wednesday, April 20, the Spring Meeting itself will get under way. Adding to the large attendance will be not only the Board members and Society members located throughout the South Atlantic District, but also a large number from the state of Florida who will take advantage of this opportunity to attend the annual meeting of the Florida Engineering Society. Still another attraction is the regular meeting of the American Shore and Beach Preservation Association, which has arranged to hold joint sessions with the Waterways Division of the Society.

These special attractions, adding to the appeal of the Florida climate at that time of the year, should prove an irresistible magnet. The splendid set-up is a tribute to the large-scale planning of the various organizations interested in the success of this meeting. The time has been so arranged that the many members who are planning to attend the meeting of the American Water Works Association in New Orleans the following week can stop off in Jacksonville en route.

Industrial Development in the Southeast

As is customary with Society meetings, the opening session on Wednesday morning, April 20, will deal exclusively with matters that are of general interest to the civil engineer and have a specific regional appeal. A number of such attractive subjects have been selected, dealing with the growth and importance of industries in the Southeast—such as lumber, pulp, paper, and phosphate. The afternoon will be given over to an interesting sight-seeing trip.

On Thursday the Technical Divisions come into their own, for the entire day will be devoted to a number of simultaneous sessions. The Waterways Division, joining with the American Shore and Beach Preservation Association, will hold both morning and afternoon meetings. The morning session will deal with general problems arising in beach and coast erosion, while the afternoon will be given over to papers and studies on specific shore projects.

Two sessions also are being planned by the Surveying and Mapping Division, those in the morning covering the use and necessity of systems of plane coordinates, and those in the afternoon dealing with various subjects related to land survey problems in the state of Florida.

Sanitary and Other Engineering Practice

Similarly, the Sanitary Engineering Division has arranged a program for the entire day. It will present for discussion a number of problems in the southeastern states, particularly runoff, groundwater supply, treatment and use of artesian surface water for municipal and industrial purposes, and the effect of industrial waste and sewage on the food-fish industry.

The Highway Division will also meet at Jacksonville, its program being aimed at the highway problems of the southeastern states, as concerned with safety design and construction, use of local materials, and progress in soil stabilization sampling and testing. Other diverse activities of engineers have not been neglected.

The Florida Engineering Society has provided amply for the interests of mechanical and electrical engineers by arranging simultaneous sessions on Thursday with such needs in mind. This attractive program should effectively provide the necessary technical background for this four-day meeting.

Florida Sight-Seeing

Such a rare opportunity to visit points of historic and engineering interest has not been lost on the Local Committee on Arrangements. To take full advantage of it, the committee has supplemented the technical side of the meeting by a number of inviting social events and excursions. Departing from the usual practice of holding an afternoon session on Wednesday, it has arranged an excursion to the ever-fascinating city of St. Augustine. This trip never fails to prove attractive to visitors, particularly the ladies.

Ponte Vedra Bath Club—Scene of Buffet Supper Party on April 20

Through the courtesy of the St. Augustine Historical Restoration

Association, members will have the opportunity of seeing what has already been done in the way of restoring this, the oldest city in the United States. Since its very beginnings in 1565, St. Augustine has been a military outpost, not only defending lands claimed by Spain, but precluding enemy occupation of its own strategic location. One of the main restoration projects has been concerned with the inner northern line of defense of the city. An elaborate system of forts and defense works included a moat with its high earthen embankment, topped with a palisade and planted with Spanish bayonets, supplemented by redoubts mounted with guns. The city gates were the only entrance to the town through this line of defense. Today the moat and the coquina bridge to this gateway have been partially restored.

Original Lines Being Renewed

In order to redevelop this line of defense accurately, it has been necessary to dig back into historic records. This has included intensive research into written documents, maps, and pictures. Based on such information, archeological investigations have ascertained the exact location of the redoubt, its dimensions and shape as well as the type and material of construction. This restoration work will be inspected by the Society party.

Originally known as Castillo de San Marcos, Fort Marion is the oldest complete fortification in the United States. It is constructed of coquina, the first building stone used by white men in this country, and was begun in 1672 and completed in 1756. In part, the fortifications at St. Augustine are due to the energy of a member of the Royal Engineer Corps of Spain, Don Antonio de Arredondo. Although commissioned to make only a report of the country, its improvements and fortifications, he was a man of action and persuaded the inhabitants to improve the existing fortresses. He also supervised the construction of Fort Matanzas without any other authority than that of the then Governor Montiano. Today Forts Matanzas and Marion are among the most impressive and beautiful of the historic monuments of the United States. Together with the other venerable and picturesque sights of the old city, they will make a most delightful objective for the Wednesday afternoon trip.

Another phase of the work of the St. Augustine Historical Restoration Association is the study of maps pertaining to this city and Florida in general. The association is compiling a bibliography of originals in the Library of Congress, at the University of Michigan, in the archives of Spain and England, as well as in Florida's own records. One plan of St. Augustine dates back to 1593. The first really important plans were those of Arredondo made in 1737. The improvement of the historic parts of St. Augustine is based upon information from these original plans. Through the courtesy of the St. Augustine Historical Restoration Association, members will have the opportunity of inspecting the work accomplished to date in replacing these ancient edifices. Plans for future work will also be explained. Following this visit, the excursion will proceed to the popular Ponte Vedra Bath Club, where a buffet supper will be served and the evening given over to sociability and dancing.

Other Trips Planned

No trips are scheduled for Thursday. Following the all-day technical meetings, a formal dinner and dance is planned for the evening in Jacksonville. This event has come to be anticipated as the social highlight of the meeting proper; it is enjoyed for its entertainment and its repast by old and young, by members, ladies, and guests.

For Friday an all-day excursion by bus is being planned. At Ocala, the party will be shown some of the work done for the Florida Ship Canal. The main objective of the trip will be a visit to Silver Springs, a spot noted for its tropical surroundings and beautiful vegetation. In particular the ride in glass-bottomed boats is a memorable one, providing a view through crystal water of the variegated and beautiful colors of fish and marine growth. The irregular lake bottom is the outlet of numberless large springs. As seen through the boats, the play of light and shadow, the myriads of brilliant colors, and the natural animal and vegetable life in all its vivid action, make a memorable scene. All who have visited this spot are enthusiastic over its many attractive features.

Members who wish to visit other places in Florida following the meeting, may do so from this point without returning to Jacksonville. For those who do return, however, a number of interesting trips have been arranged for Saturday. Among them is a visit to the Marine Studios at Marineland, Fla., where many unique features both as to construction and operation are to be seen. These studios are constructed for the purpose of making motion pictures of large tropical fishes and other marine life. They comprise the largest so-called tropical-fish tanks in existence. For those who are interested in industrial development, other trips are available, such as a visit to the Fernandino Pulp Mills, the turpentine plant of the Naval Stores Experiment Station, and a tung oil plant.

During the meeting, also, ample provision has been made for the entertainment of visiting ladies. A special committee has been active for many months and has planned a number of drives and other features which should appeal particularly to every visiting lady.

Experience has taught the people of Jacksonville how best to cater to the comfort and enjoyment of visitors. The time of this meeting is so chosen as to take advantage of the early spring season, which is always delightful in Florida, in part because it is free from the mid-winter crowds. As still another factor may be mentioned the combination of technical interest which will bring together a number of organizations for joint technical sessions and attendant social features. It is therefore fair to expect that the Jacksonville Spring Meeting will set a high standard of excellency and will attract a large attendance of members and their families in keeping with the excellent program afforded. No pains are being spared to make this, the first Society meeting in Florida, a notable event.

In This Issue . . .

Meeting of Outgoing Board of Direction—Secretary's Abstract

On January 17 and 18, 1938, the Board of Direction met at Society Headquarters, with Vice-President Edward P. Lupfer in the chair; and present George T. Seabury, Secretary; Past-Presidents Tuttle and Mead; Vice-Presidents Dennis, Bellinger, and Gowdy; Directors Arneson, Burdick, Crawford, Davis, Dean, Ferebee, Finch, Hidinger, Hill, Legaré, Leisen, Morse, Myers, Needles, Proctor, Shea, Stabler, Stanton, and Treasurer Hovey.

Regrets from President Hill

News of the illness of President Hill, confining him to his bed, was received with great regret.

New Director

Because of the death of C. Arthur Poole, Director for District 3, since the last meeting of the Board, and in order that the District might be represented at this meeting, his successor, Arthur W. Harrington, was invited to sit with the Board with the privilege of voting.

Annual Report

The Annual Report of the Board was read and, with minor revisions, approved. Extracts from this report appeared in the February issue; the complete report will appear in the Society Year Book, April 1938 Proceedings, Part 2.

Approval of Minutes

Minutes of the Executive Committee meeting of October 3, 1937, and of the Board of Direction meeting of October 4–5, 1937, were approved.

Amendment to By-Laws

A proposed amendment to the By-Laws referred to Article IV, "Committees." Section 7, covering "the Committee on Membership Qualifications," was amended as to the procedure of the committee, so that the Section now reads:

"7. The Committee on Membership Qualifications shall consist of six Directors, two to be selected from each class. The

Committee shall review all applications for admission and transfer and shall act thereon or report to the Board of Direction in accordance with the provisions of Article I of the By-Laws, as supplemented by rules prescribed by the Board from time to time."

Changes in Division and Section Constitutions

Minor changes in the constitution of the Soil Mechanics and Foundations Division and in the constitution of the District of Columbia Section were approved.

Hydraulic Fellowship to Honor J. Waldo Smith

Approval was given to the establishment of a Research Fellowship in Hydraulics, in partial use of the proceeds of the J. Waldo Smith Fund. The general features of such a fellowship were determined as given elsewhere in this issue. The method of administering this matter was left for later determination.

Accredited Schools

Report from the Committee on Accredited Schools was read and discussed. In effect it recommended that the Society adopt the accrediting performed by the Engineers' Council for Professional Development with necessary provisions for those institutions (and their Student Chapters) heretofore accepted by the Board but not yet accredited by E.C.P.D. The Board adopted the committee's recommendations, details of which will be found elsewhere in this issue.

Student Chapters

Report of the Committee on Student Chapters was received, and approval was given to the recommendation that 12 Chapters should receive letters of commendation for meritorious work during 1936–1937, as noted in a separate item in this issue.

Registration of Engineers

Following the suggestion of the Committee on Registration of Engineers, the revised Model Law, as printed in December 1937, was approved and endorsed.

Geographical Limits of Local Sections

Recommendation of the Committee on Local Sections relative to the areas to be allocated to each Section was received and discussed. After revision the report was adopted. An item in the February issue gave the details of this action, including Section areas.

George H. Pegram, Honorary Member

The President was authorized to appoint a committee to prepare a memoir for George H. Pegram, Past-President and Hon. M. Am. Soc. C.E.

Committee on Fees

Following recommendation of the Committee on Fees, the printing of a pamphlet entitled "Recommendations for Determining Fees," on letter-size sheets, was authorized for distribution to members.

Aims and Activities

Report was received from the Committee on Aims and Activities, and the committee was discharged with thanks.

Future Society Meetings

Date for the Annual Convention at Salt Lake City was fixed as July 20–22, 1938.

Similarly for the Fall Meeting at Rochester, N.Y., the date of October 12–14, 1938, was confirmed.

After discussion, decision was reached that the 1939 Fall Meeting be held in New York City, this being at the time of the New York World's Fair.

Joint Committee Dissolved

A joint committee of the Society and the American Institute of Chemical Engineers was authorized in 1932 to study the question of pollution of waters. Being advised that the Institute had discharged its representatives on the committee, the Board voted also to discharge the Society's representatives, with thanks.

Districts and Zones

On recommendation of the Committee on Districts and Zones it was voted that the present limits be retained for the year 1938.

Membership

Acting as a Membership Committee, the Board studied and passed on many cases of application for admission or transfer.

Salaries

A progress report was received from the Committee on Salaries. The committee is employing expert technical assistance and is cooperating with representatives especially appointed from the Local Sections. It hopes to have its final report, with classifications of positions and appropriate salaries, some time during the year.

Professional Activities Division

Progress was reported on a study being made as to the desirability of setting up a new Professional Activities Division in the Society. This Division, if formed, would require correlation with other Society activities, possibly necessitating basic changes in the functional relations of various parts of the organization.

Unionization of Engineers

A comprehensive report was received from the Committee on Unionization of the Engineering Profession, which report was accepted. An abstract of the report, with the conclusions reached by the committee, is printed elsewhere in this issue.

C. Arthur Poole

An appropriate resolution on the death of C. Arthur Poole, Director from District 3, was adopted. This resolution appears in full elsewhere in this issue.

Budget Recommended

Various financial matters were discussed in detail. With resulting revisions, the proposed budget for 1938 was ordered transmitted to the incoming Board with recommendation for adoption.

Thanks to Chairman

The Board unanimously recorded its appreciation and thanks to Vice-President Lupfer for the conduct of its sessions.

Other Matters

A number of administrative and routine subjects were discussed; reports of various committees were presented; and in all cases appropriate action was taken.

Meeting of Incoming Board of Direction—Secretary's Abstract

THE BOARD of Direction met at the Headquarters of the Society on January 20, 1938, with President Henry E. Riggs in the chair; and present George T. Seabury, Secretary; Past-President Mead; Vice-Presidents Bellinger, Gowdy, Noyes, and Pirnie; and Directors Agg, Anderson, Arneson, Ayres, Davis, Dean, DeBerard, Finch, Harrington, Hidinger, Hill, Legaré, Myers, Needles, Proctor, Root, Shea, Stanton, Tiffany, and Treasurer Hovey.

Budget for 1938

Proposed expenditures by the Society in 1938 were discussed in detail as recommended by the outgoing Board; with revisions the budget for the year was adopted.

New Committees

The President nominated members of Board and Society committees. These nominations were adopted by the Board for the personnel during 1938, as follows:

EXECUTIVE COMMITTEE: Henry E. Riggs, *Chairman;* Malcolm Pirnie, *Vice-Chairman;* Daniel W. Mead, R. C. Gowdy, and Carlton S. Proctor.

COMMITTEE ON HONORARY MEMBERSHIP: Henry E. Riggs, *Chairman;* Daniel W. Mead, L. C. Hill, L. F. Bellinger, R. C. Gowdy, E. N. Noyes, and Malcolm Pirnie.

COMMITTEE ON DISTRICTS AND ZONES: E. P. Arneson, *Chairman;* T. R. Agg, James A. Anderson, R. P. Davis, and Carlton S. Proctor.

COMMITTEE ON PROFESSIONAL CONDUCT: L. L. Hidinger, L. F. Bellinger, R. P. Davis, Arthur W. Dean, T. E. Stanton, Jr., and R. K. Tiffany.

Committee on Publications: James K. Finch, *Chairman;* Louis E. Ayres, A. W. Dean, C. E. Myers, and E. R. Needles.

Committee on Membership Qualifications: R. A. Hill, *Chairman;* E. P. Arneson, W. W. DeBerard, Arthur W. Harrington, T. Keith Legaré, and William J. Shea.

Committee on Regional Meetings: *Annual Meeting:* Malcolm Pirnie, *Chairman;* James K. Finch, E. R. Needles, Carlton S. Proctor, and William J. Shea.

Spring Meeting: L. F. Bellinger, *Chairman;* James A. Anderson, E. P. Arneson, R. P. Davis, L. L. Hidinger, and T. Keith Legaré.

Annual Convention: R. C. Gowdy, *Chairman;* T. R. Agg, R. A. Hill, E. N. Noyes, T. E. Stanton, Jr., and R. K. Tiffany.

Fall Meeting: Malcolm Pirnie, *Chairman;* L. E. Ayres, Arthur W. Dean, W. W. DeBerard, A. W. Harrington, C. E. Myers, and J. E. Root.

Committee on Research: Albert F. Reichmann, *Chairman,* term ending January 1939; Boris A. Bakhmeteff, term ending January 1940; C. H. Paul, term ending January 1941; Clyde T. Morris, term ending January 1942; and James A. Anderson, *Contact Member.*

Committee on Local Sections: E. B. Black, *Chairman,* term ending January 1939; A. T. Dusenbury, term ending January 1940; James W. Follin, term ending January 1941; J. T. L. McNew, term ending January 1942; and T. E. Stanton, Jr., *Contact Member.*

Committee on Juniors: Howard R. Green, *Chairman,* term ending January 1939; N. T. Veatch, Jr., term ending January 1940; S. B. Lilly, term ending January 1941; E. W. Bowden, term ending January 1942; and T. R. Agg, *Contact Member.*

Committee on Student Chapters: R. B. Wiley, *Chairman,* term ending January 1940; E. M. Hastings, term ending January 1939; A. H. Holt, term ending January 1941; John H. Porter, term ending January 1942; and James A. Anderson, *Contact Member.*

Committee on Engineering Education: Joseph W. Barker, *Chairman,* term ending January 1939; Leslie F. Van Hagan, term ending January 1940; Samuel B. Morris, term ending January 1941; T. C. Adams, term ending January 1942; and A. W. Dean, *Contact Member.*

Committee on Registration of Engineers: Joseph Jacobs, *Chairman,* term ending January 1939; Ralph J. Reed, term ending January 1940; J. H. Dorroh, term ending January 1941; W. C. E. Becker, term ending January 1942; and T. Keith Legaré, *Contact Member.*

Committee on Fees: Frank A. Marston, *Chairman,* term ending January 1940; J. Vipond Davies, term ending January 1939; Walter L. Huber, term ending January 1941; Ernest E. Howard, term ending January 1942; and E. R. Needles, *Contact Member.*

Committee on Salaries: E. P. Goodrich, *Chairman;* A. B. McDaniel, *Vice-Chairman;* E. O. Griffenhagen, Arthur Richards, and J. E. Root, *Contact Member.*

Committee on Public Information: William H. Adams, *Chairman,* term ending January 1940; T. R. Kendall, term ending January 1939; Harry L. Kinsel, term ending January 1941; E. O. Sweetser, term ending January 1942; and James K. Finch, *Contact Member.*

Committee on Technical Procedure

Henry E. Riggs, *Chairman*
R. C. Gowdy, Board Member
Malcolm Pirnie, Board Member
Harold M. Lewis, *Chairman,* City Planning Division
Daniel T. Webster, *Chairman,* Construction Division
Frederick H. McDonald, *Chairman,* Engineering Economics Division
Leslie G. Holleran, *Chairman,* Highway Division
Augustus Griffin, *Chairman,* Irrigation Division
Silas H. Woodard, *Chairman,* Power Division
H. W. Streeter, *Chairman,* Sanitary Engineering Division
Carlton S. Proctor, *Chairman,* Soil Mechanics and Foundations Division
Almon H. Fuller, *Chairman,* Structural Division
William Bowie, *Chairman,* Surveying and Mapping Division
W. G. Atwood, *Chairman,* Waterways Division
Albert F. Reichmann, *Chairman,* Committee on Research
James K. Finch, *Chairman,* Committee on Publications
George T. Seabury, *Secretary*

Committee on Professional Activities: Henry E. Riggs, *Chairman;* T. R. Agg, James A. Anderson, A. W. Dean, James K. Finch, T. Keith Legaré, E. R. Needles, J. E. Root, T. E. Stanton, Jr., and George T. Seabury, *Secretary.*

Committee on Accredited Schools: John C. Riedel, *Chairman,* term ending January 1939; W. C. Huntington, term ending January 1940; L. M. Gram, term ending January 1941; Ivan C. Crawford, term ending January 1942; and C. E. Myers, *Contact Member.*

Committee on Freeman Fund: Thaddeus Merriman, *Chairman;* Malcolm Pirnie, and Walter E. Spear.

Committee on Society Property: Lincoln Bush, *Chairman;* George S. Davison, and Arthur S. Tuttle.

Committee on Alfred Noble Prize: Robert Ridgway, *Chairman.*

Committee on American Engineering Council: Alonzo J. Hammond, Daniel W. Mead, Henry E. Riggs, George T. Seabury, and Arthur S. Tuttle.

Routine Activities

A number of other incidental matters having to do with Society administration and with Board procedures were discussed and acted upon.

Adjournment

The Board adjourned to meet in Jacksonville, Fla., on April 18, 1938.

J. Waldo Smith Fund to Provide Research Fellowships in Hydraulics

Under the terms of the will of the late J. Waldo Smith, Hon. M. Am. Soc. C.E., the Society has become one of the beneficiaries of the estate. The proceeds have been set aside as the J. Waldo Smith Fund and a committee, of which Thaddeus Merriman is chairman, has been studying the various possibilities for best utilization by the Society in terms of current professional needs as linked to the life interests of the donor.

As a result it has been suggested, and the Board of Direction at its January 17, 1938, meeting approved the suggestion, that part of the proceeds be devoted year by year to the establishment of a Research Fellowship in Hydraulics. Administration is to be in part through the institution which shall invite cooperation, through its engineering faculty. It is proposed that the fellowship run for a full year and provide \$600 plus as much more up to \$400 as may be required for physical equipment connected with the research. Such equipment becomes the property of the institution upon completion of the work.

Applications for the fellowship are to come through the various institutions applying. The award is then made to that graduate student, preferably a Junior of the Society, who gives promise of best fulfilling the ideals of the fellowship.

Under the provisions adopted by the Board, the scope of the fellowshp should be restricted to research in the field of experimental hydraulics as distinguished from that of purely "theoretical hydraulics." To this end emphasis is to be placed on practical experiments designed and executed for the purpose of advancing knowledge with respect to the laws of hydraulic flow rather than to the type of research which proceeds on the theory of mathematical analysis based on assumptions of unknown validity. The essence of the purpose of the research is to test the assumptions which are currently made, and also to develop a better understanding of fluid flow. This line of approach was characteristic of the great success of the man through whose generosity this fund has become available, and it is therefore most appropriate that the methods he followed should be further developed.

It seemed fitting to the Board, and it was therefore voted, that the first fellowship, to be given in 1938–1939, be offered to the Massachusetts Institute of Technology which was Mr. Smith's Alma Mater. A committee authorized by the Board is to handle the details.

Special Committee on Unionization Reports

THE BOARD of Direction at its January meeting received and ordered published the main features of the report of a Special Committee on Unionization of the Engineering Profession. Appointment of this committee was authorized at the Society's 1937 summer convention at Detroit. It was instructed to report on the extent of the union movement among engineers and subprofessional men in the engineering field and to study the professional questions involved. The committee consisted of: V. T. Boughton, chairman, R. A. Hill, representing the Board, Clifford A. Betts, H. J. Brunnier, R. P. Forsberg, Roy M. Green, J. H. Herron, W. C. Hogoboom, R. P. Howell, F. J. Lewis, and Arthur V. Sheridan. An abstract of its report follows.

EXISTING UNIONS

Technical Engineers', Architects', and Draftsmen's Unions. The oldest, and until recently the largest union in which engineers and other technical men are members is the International Federation of Technical Engineers', Architects', and Draftsmen's Unions, an A. F. of L. affiliate, with headquarters at Washington, D.C. This union has been in existence for twenty years. It is organized along conservative lines of A. F. of L. unions and generally operates in a conservative way. Local unions are subordinate to and governed by rules of the International Federation.

The T.E.A.D.U. has a large membership in shipyards, navy-yards, and among civil service employees in some of the major cities. Since labor organizations came into power in the Northwest, it has been active in organizing city employees and the engineering employees of highway departments, notably that of the state of Washington.

The total membership as given in the 1936 edition of the *Handbook of American Trade Unions* (U. S. Department of Labor) is 3,800. Membership is open to "technical engineers, architects, and draftsmen who are in an employee capacity." How many actually are engineers it is impossible to determine. The T.E.A.D.U. has local unions in California, the District of Columbia, Georgia, Maryland, Massachusetts, Nebraska, New Hampshire, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Carolina, Virginia, Washington, and Wisconsin. Figures as to membership in these locals are not available.

Federation of Architects, Engineers, Chemists, and Technicians. A direct outgrowth of the NRA is the Federation of Architects, Engineers, Chemists, and Technicians. This union was formed in New York and its organizers took an active part in discussions of the construction code, architects', chemists', and engineers' codes under the NRA.

Membership at the time of the third annual convention held in Detroit in October was put at 5,000. During 1937 a few large A. F. of L. unions switched over to this C.I.O. group, the largest and probably the most important acquisition being the Minnesota Highway Employees Association, formerly local No. 71 of the T.E.A.D.U., with a membership of 1,000. Under date of December 7, 1937, the total membership was reported as 7,100. The F.A.E.C.T. claims 2,000 members in New York, 700 in Philadelphia, 450 in Pittsburgh, 900 in Chicago, 400 in Detroit, 1,200 in Minnesota, 200 in Washington, 125 in Los Angeles, 200 in San Francisco, and 300 in Boston, with the remainder scattered over the country.

Other Unions. Unions such as the International Union of Office and Professional Workers (C.I.O.), the National Engineers' Guild (Independent), at Los Angeles, and the Society of Designing Engineers (C.I.O.) which is made up chiefly of automotive designers at Detroit are chiefly of local significance. It is believed that quite a few engineers are members of the National Federation of Federal Employees (Independent) and of the American Federation of Government Employees (A.F. of L.), but these organizations have a somewhat different set up from a normal trade union; hence membership of engineers in these organizations does not appear to be significant to the present discussion.

There has been formed in the Tennessee Valley an association called the TVA Engineers' Association which is worthy of note as indicative of what can be done when engineers feel that it is desirable to unite for collective action independent of a trade union. This organization is simple in structure and without outside affiliations, yet it is able to function in a dignified way for the economic advancement of the members of the group.

LEGAL STATUS OF THE ENGINEER

The legal status of engineers under the Wagner Labor Relations Act has been uncertain until quite recently. As a result, the National Society of Professional Engineers at its annual meeting in October 1937, adopted a resolution calling for an amendment or an interpretation of the act that would clarify the position of engineers and other professional men. It was then feared that engineers might be compelled to join vertical unions in which their entity would be lost and their peculiar problems unrecognized.

In November this situation was cleared up considerably by a ruling of the National Labor Relations Board with respect to engineers in the West Allis plant of the Allis-Chalmers Manufacturing Company. These engineers have their own independent union. The board ruled that it should be recognized as a separate bargaining agency and that even though the engineers subsequently voted to join the plant local of the U.A.W.A. they still will be considered a separate bargaining group. This is a very encouraging development.

COERCION OF ENGINEERS

Though there have been numerous reports that engineers have been forced to join unions against their will, no positive evidence of coercion has been found. However, coercion is difficult to prove, and men who may have been forced to join a union against their best judgment would naturally refrain from laying themselves open to further difficulty. Also it is worthy of note that a closed-shop agreement must result in coercion of employees who do not belong to the union if they are to hold their jobs. As both major union groups favor closed-shop agreements, coercion is not out of the question.

CONCLUSIONS AND RECOMMENDATIONS

The whole matter of unionization of engineers is in a state of flux. Its ultimate outcome will depend in no small measure upon the attitude adopted by the men who now stand in influential positions in the engineering profession. If they will take an open-minded attitude and will do what they can to help underpaid engineering employees to improve their economic condition, it can be confidently expected the need for collective action by engineers will be greatly diminished and the collective-bargaining agencies that will represent engineering employees in the future will have few if any of the unfavorable characteristics of trade unions as we know them today.

Since this committee was named, much has been written and said for and against the unionization of engineers. Within the Society itself diametrically opposite views are found. Some members hold that a man cannot be both a professional man and a member of a trade union; others hold that it is quite possible for him to retain high professional ideals and at the same time join with his fellows in collective action to improve their working conditions or even to protect themselves against aggression by other organized groups. These opposing views arise from the fact that those who can see no good in unionism base their conclusions on knowledge of the bad practices of some of the trade unions rather than upon the fundamental principles upon which the unions are built. The principles are sound and now are the law of the land; those who have turned to trade unions for the solution of their economic ills hold that the bad practices can be eliminated. It would be a serious mistake for the Society to set up any bar against the efforts of these men to perfect any agency that they believe will improve their economic position.

Nor should the Society take a negative attitude in the matter. It should continue its activities directed towards improving the standards of compensation for engineering employees, and if the occasion arises should stand ready to participate in moves to improve the position of engineers under the Wagner Act.

To these ends the committee makes the following recommendations:

1. Membership in a trade union is primarily an economic matter. Therefore the American Society of Civil Engineers should consider such membership as having no more bearing on a man's

qualifications for membership in the Society than have his religious or political affiliations.

2. The Wagner Labor Relations Act has encouraged the extension of existing unions and the formation of others; it has paved the way for complete unionization of the employees of many industries and may be expected to result in the formation of collective bargaining groups in all plants and offices where any considerable numbers of men are employed. Engineers and architects as well as draftsmen and other subprofessional men are not and cannot be exempted from the provisions of the act. Therefore, the Society should not participate in any movement to amend the act to exclude professional men from its provisions. Such a movement would be bound to fail, as many engineers believe that collective bargaining can be made to work to their advantage and will fight for their rights under the Wagner Act.

3. The Society should support efforts to amend the Wagner Labor Relations Act to clarify the position of professional and subprofessional men under the act should that appear necessary.

4. Extension of unionization to include a large part of the employees of some industries and its possible extension to many other organizations has made it desirable in some instances for engineers to organize to protect their own rights. In other instances engineers have organized or have joined existing trade unions in the belief that they can better their economic position thereby.

These existing trade unions are far from ideal to represent engineers in collective action. Experience has shown that such action can be taken by engineers themselves without resort to strikes and other trade-union tactics. Therefore, on the assumption that the need for facilities for collective action by engineers will increase at least temporarily in the future as the organization of industry expands, the Society should stand ready to cooperate with other Founder Societies or with state and national professional societies in the establishment of temporary or permanent agencies to represent engineers in collective action in a dignified professional manner whenever necessary.

5. To minimize the need for collective action by engineers as well as to assist its members in establishing and maintaining adequate and reasonably uniform compensation for the several grades of engineering employment, the Society should adopt a schedule of grades and minimum compensation such as is now before the Board of Direction. The Society should seek actively to have such a schedule widely accepted and should be prepared to cite a member for unethical practice who pays less than the established minimums for the region in which his business in conducted, except under emergency conditions.

Officers' Dinner Precedes Annual Meeting

At the time of the Society's Annual Meeting, a number of gatherings are held, having common backgrounds or appealing to various members of the Society. The alumni reunions and the meetings scheduled by the Institute of Consulting Engineers and by the New York State Sewage Works Association are especially familiar.

One group that has been meeting quietly year after year is especially close to the Society—the meeting goes under the name of the Past and Active Officers' Dinner, since the attendance is drawn largely from those who were formerly members of the Board of Direction. The date is always on the Tuesday evening preceding the Annual Meeting, thus making it convenient for a group of loyal out-of-town members who yearly take this occasion for a visit to New York.

It is of interest to recall the origin of this meeting, as recounted by Dr. T. Kennard Thomson, from his memory of the first event of this kind. Previously, he relates, "it was customary for the Outgoing Board to give a dinner to the Incoming Board. The last of these dinners was presided over by the President, George Swain, in January 1914. I realized that these dinners were not on a satisfactory basis, and were sometimes a burden on the Outgoing Board. Therefore, I made a suggestion that we form a new Society of Past and Present Officers, every eligible member becoming a member automatically for life, with no entrance fees or annual dues. The meetings were to take the form of one banquet every year preceding the Annual Meeting. This suggestion was adopted, and President Hunter McDonald presided at the first such dinner in January 1915. Needless to say, it has been a great pleasure to see how these banquets have been improved—by including our secretarial staff, Honorary Members, and important guests."

As mentioned by Dr. Thomson, the original idea for the dinner has been expanded somewhat by including those who have some special relation to the Society's Annual Meeting. For example, new Honorary Members are always invited, also the winners of Society prizes and the chairmen of the Technical Divisions, and finally the engineers on the Headquarters staff. In all, 94 were in attendance at this year's dinner, January 18, 1938.

Informality is the rule at these gatherings. Old friends get together to exchange stories and reminiscences. At times, the good will reaches such a pitch that singing (of a sort) gives an outlet to the exuberance of the older and younger guests.

Particular pains are taken to make the newer men feel perfectly at home. Following the dinner, the new Honorary Members are introduced and they make brief but fitting comments. The same procedure follows for the winners of Society prizes to be officially awarded the following day at the Annual Meeting. Then each retiring Vice-President is asked to introduce his successor, again with appropriate response; and similarly for the retiring Directors and their successors in turn. The introductions are completed by presentation of the officers of the Divisions and staff members.

In this way a sort of cross-section of official Society activity from a professional standpoint is presented to the novitiates. The form

One of the Early Officers' Dinners, January 18, 1916
Later Banquets, in This Same Room at the Engineers Club, New York, N.Y., Have Followed the Policy Originated in 1914. The Wartime Influence Is Here Indicated by the Flag Decorations

of introduction differs with the personalities involved. It is of interest to note the various methods of approach; in some instances the professional standing and technical accomplishments of the new men are emphasized, while another introduction may almost entirely overlook that phase by dwelling upon individuality and hobbies or by indulging in a little banter for full measure. Whatever the method, the welcome is cordial and in the best of humor.

Finally, the President-elect is acclaimed by a rising welcome, and he responds according to the prevailing mood. At this year's dinner an added function consisted of the distribution of a number of engrossed testimonials recording the completion of various terms of elective office in the Society.

Another interesting feature of the meeting was the showing of a series of motion-picture shots owned by the Society and depicting various officers of the past forty-five years, including a number who are still active and many who have died. These loyal servants of the Society, by their animated presence on the screen, added in spirit and in inspiration to the pleasure of the 1938 dinner. These films represent the results of long-continued effort on the part of Harry W. Dennis and John N. Chester, former Vice-Presidents of the Society.

Sanitary Engineering Division Adopts Resolution on Stream Pollution

THE Sanitary Engineering Division, among other activities during the past year, has concerned itself with the subject of control of stream pollution. It has been interested particularly in the findings of the Society's Special Committee on National Water Policy. This subject was extensively discussed at the meeting of the Division on January 20, 1938.

As a result of the lengthy comments by various members, including the Special Committee, the Division went on record as approving the recommendations of its executive committee as expressed by the adoption of the following resolution:

"WHEREAS, the Board of Direction of the American Society of Civil Engineers voted on February 3, 1936, in the matter of National Water Policy:

"'1. That for the present no further extension of federal control over streams is desirable; that the federal government should restrict its activities in this field to the functions of fact-finding and coordination and stimulation of state and interstate programs, and that initiation, administration, and financing of projects should be reserved for state and interstate action, and

"'2. That this expression of policy be communicated to the Society's Committee on National Water Policy, and that the committee be authorized to let this expression of policy be known if and when legislation is introduced in the Congress of the United States to place the control of pollution of water under the federal government, and

"'3. That American Engineering Council be advised of the above expression of policy and be asked to assist in making it known as may appear practicable or helpful.'

"AND WHEREAS, the original Vinson Bill H.R. 12764 of the 74th Congress offered a satisfactory means of solving the problem of stream pollution within the policy of the Board of Direction expressed on February 3, 1936, and

"WHEREAS, the amended Vinson Bill H.R. 2711 as it passed the Senate of the 75th Congress contains certain provisions contrary to the public interest as expressed by the vote of the Board of Direction of February 3, 1936, and

"WHEREAS, it is the sense of this Division that H.R. 2711 in its present form will deter rather than promote stream pollution remedial work,

"*Be it resolved*, that the 1938 annual meeting of the Sanitary Engineering Division go on record as in favor of the policy expressed in H.R. 12764 of the 74th Congress and as opposed to Section 8 of the said H.R. 2711 of the 75th Congress, now in the hands of conferees.

"*Be it further resolved*, that a copy of this resolution be presented to the Board of Direction of the American Society of Civil Engineers."

Accredited Engineering Curricula

WHEN the Engineers' Council for Professional Development in October 1937 adopted a list of accredited engineering curricula, the Society was immediately faced with the problem of correlating this accredited list with the group of engineering schools that have enjoyed a particular relationship to the Society. This relationship has been beneficial, first, with respect to credits for professional work that may be allowed to graduates of approved engineering schools, and second, as one of the requirements that must be possessed by an engineering school at which a Student Chapter of the Society is to be established.

In effect, E.C.P.D. divided the engineering schools of the United States into two groups, the first, defined by a published list, containing the engineering curricula that were approved in the course of its accrediting procedure, and the second, inferred through omission from that list, containing those that presumably have not yet demonstrated that they meet certain minimum requirements or which, in a few cases, may not as yet have requested accrediting. Only the accredited group is given publicity.

The Society on the other hand sees three groups: The first consists of the institutions that heretofore have been acceptable to the Board of Direction and that now appear on the E.C.P.D. list; the second contains those that were not formerly acceptable to the Board and which do not now appear on the E.C.P.D. list; and the third, a group containing those institutions that have been heretofore acceptable to the Board but which are not now accredited by E.C.P.D. It is with this last group that the Society is particularly concerned.

The Society's Committee on Accredited Schools, with the collaboration of the Committee on Student Chapters, has given a great deal of study to the problem and made recommendations to the Board of Direction which the Board adopted at its January meeting. In effect, those recommendations were to adopt the E.C.P.D. accredited list but also to notify the institutions in the third group previously noted that they are to be given a provisional status until January 31, 1940, to give them an opportunity to overcome deficiencies that may be keeping them off the E.C.P.D. list.

With respect to credits involved in membership applications, curricula in other than civil engineering courses are considered. For example, graduation from an approved curriculum in mechanical engineering may be given credit as four years of professional work, since the Constitution provides that a mechanical engineer may become a member of the Society.

With respect to the establishment of Student Chapters, the eligibility of an institution for a new Chapter is contingent first upon the status of the civil engineering curriculum, and then upon certain additional requirements of a simple nature. It has been found that at the present moment 22 Chapters are located in engineering schools whose civil engineering curricula do not appear on the E.C.P.D. list. The Society's Committee on Accredited Schools recommended that no action be taken until January 1940 concerning the discontinuance of existing Chapters at institutions as yet not accredited by E.C.P.D.

In this whole matter the Committee did not wish to recommend precipitate action of an adverse nature regarding institutions which have heretofore had the benefits of an approved status with the Society. Two years hence the schools on the provisional list will have been reallocated one way or the other, and at that time the Chapter situation will be re-studied in view of developments to that date.

In adopting this lenient policy the Board is aware that while the status of a curriculum is of great importance, it is nevertheless true that the graduates of such non-accredited schools will ultimately enter the profession and many of them will become first-rate members of the Society. It is a frequent observation that the Student Chapter provides an excellent medium—in some cases perhaps the only organized medium—for the cultivation of a professional attitude in the engineering student. The Society very properly has a sense of obligation to all civil engineering students with respect to enhancing their professional outlook and therefore should hesitate to withdraw any Student Chapter that appears to be functioning properly. During the interim prior to January 1940, studies will continue to the end that sound policies and procedures may be adopted to encourage all engineering students to adopt the professional attitude that the Society endeavors to foster.

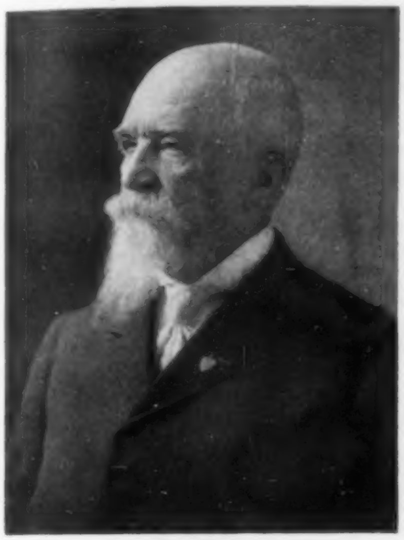
Early Presidents of the Society

XXIV. William Price Craighill, 1833–1909

President of the Society, 1894

Readers are urged to keep in mind that their cooperation in supplying photographs, anecdotes, and other data helps to make these sketches readable and informative. The next three articles will deal with George Shattuck Morison, Thomas Curtis Clarke, and Benjamin Morgan Harrod.

It was a class destined for fame that left the U. S. Military Academy in 1853. There were McPherson, Schofield, Sheridan, Sill, Sooy-Smith, Terrill, Vincent, and Tyler, who in a dozen years or less would all be generals in the Union Army; there were Chambliss, Hood, and Walker, due for equal and as rapid distinction in the Confederate ranks. There was, also, William Price Craighill, youngest of the class, who for reasons of sentiment refused to seek advancement in the Civil War, but who ultimately became brigadier-general and Chief of Engineers.



William Price Craighill
Twenty-Fourth President of the Society

Craighill was born at Charleston, W.Va. (then Virginia) in 1833. His appointment to the Academy came when he was but 16 years of age; nevertheless, at graduation he stood second only to McPherson. He spent his first years of service in river and harbor work and in the office of the Chief of Engineers, and in 1861 was at the Point, as principal assistant professor of engineering, when the fateful action of the Virginia legislature forced him to choose between allegiance to his native state and to his nation.

On the one hand were family and friends and the pride of his ancestry; four generations of Craighills had helped to carve Virginia from the wilderness. On the other hand was his sincere belief that the ultimate welfare of the country as a whole depended on the success of the Union cause. After long and anxious consideration, Craighill cast his lot with the Union—but it may almost be said that he did so with a perfectly honorable mental reservation: that in the war in which he found himself opposed to his own people he would steadfastly refuse to seek personal advancement and distinction.

Craighill remained on duty at the Point until June of 1863. In the preceding summer, however, he had been temporarily assigned as Chief Engineer of General George W. Morgan's Division of the Army of the Ohio, and had engaged in the defense of Cumberland Gap, serving so meritoriously that Morgan wrote (October 12, 1862):

"Nor can I close this report without calling the attention of the Commanding General to the important services rendered me by Lieut. W. P. Craighill of the Engineer Corps. He is an officer of distinguished merit, and is thoroughly informed on all subjects connected with the art of war. He would make an able Chief of Staff, or fill with high credit any other position to which he may be assigned, and deserves a much higher grade than he now holds."

In 1863 Craighill was assigned as Chief Engineer of the Department of the Monongahela. At that time Pittsburgh was under threat of raid by Gen. John Morgan—or so, at least, the inhabitants thought—but neither money nor man power appeared to be forthcoming from the federal government for the building of defenses. Here again Craighill demonstrated his ability both as an officer and as an engineer; using only volunteer labor and the contributions of the citizens, he constructed a complete line of defensive works about the city, and took just ten days for the job.

Later in the war Craighill was assistant engineer in the construction of the defenses of Baltimore, and served on boards for the defenses of New York, Willets Point, and San Francisco (when the French were in Mexico and threatened to invade California). Mention should also be made of "The Army Officer's Pocket Companion," which he compiled while on duty at West Point, and which proved very useful to the Volunteer Army.

In 1865 he was made brevet lieutenant-colonel "for faithful and meritorious services during the war." He was also offered the brevet of colonel, but this he declined. At the close of the war he was commissioned as major and assigned to the Baltimore District in charge of constructing fortifications and river and harbor improvements. There he remained (except for a four-year tour of duty as assistant to the Chief of Engineers) until his final promotion in 1895.

The river and harbor works under his jurisdiction extended from the Susquehanna to the Cape Fear River, and as far west as the Great Kanawha, in West Virginia. In Baltimore Harbor, the dredged channel constructed by him in 1864 bears his name. It was he who conceived the idea of locating this channel on the line of the resultant of the forces of the currents acting upon it, and the principle was amply justified by the manner in which the channel maintained itself after the initial dredging.

The improvement of the Cape Fear River presented a notable engineering problem, and the successful closing of the false mouth across the shifting sands of the coast was of great importance. In this work was evolved the log-and-brush mattress, used extensively later on the South Atlantic Coast.

Perhaps the most important of the river-improvement works was the canalization of the Great Kanawha, during the 1880's. The project consisted of ten locks and dams providing slack-water navigation from the mouth of the river (at Point Pleasant, on the Ohio) to above Charleston, W.Va., and was intended primarily for coal commerce. It is of especial interest from an engineering standpoint in that it included the first movable dams for slack-water improvement to be constructed in the United States.

These dams were of the Chanoine wicket type, shown in section in the accompanying illustration. It is believed that their introduction in this country was mainly due to Colonel Merrill, with whom Craighill visited Europe in 1878 for an inspection of works of that character. However, Merrill's dam, at Davis Island, on the Ohio, was not completed until two on the Kanawha had been in service for five years.

Traffic on the Kanawha developed rapidly after the canalization. In 1880 there were but two mines above the Charleston pool shipping by river, and they shipped a bare 8,000 tons a year. A decade later there were 17, shipping over a half-million tons, and mines below Charleston supplied an equal amount. There were also freight shipments of other sorts, and many passengers, from Charleston and above to Cincinnati, Pittsburgh, and other Ohio River ports.

In 1884 the Corps of Engineers inaugurated the system of grouping a number of districts into a division, and Craighill, now a colonel, headed the Southeast Division, his headquarters remaining at Baltimore. This experimental unit, with a number of the younger officers of the Corps as its district engineers, was known as "the Kindergarten." Craighill, it appears, was a good teacher, for he made it a point to throw every possible responsibility directly on the younger men, and to approve their methods wherever practicable. "I have found," he once said, "that generally there are several ways of accomplishing a given result, and that it is best to follow the plan of the man who is to do the work providing the plan be sensible." On another occasion he said to a young officer reporting to him for duty, "Mr.——, I propose to be the laziest man in this district, and do not propose to do anything that I can have done by one of my assistants."

The jurisdiction of the "Kindergarten" extended to such important harbors as New York, Philadelphia, Baltimore, Norfolk, Charleston, and Savannah. Craighill in addition assisted in formulating the improvement plans for many rivers and harbors outside that area, among them the Mississippi, Ohio, James, and Columbia.

He also was for several years a member of the Light-House Board.

Craighill's greatest military contribution was in connection with coast defenses. Incidentally, his first assignment after graduating from West Point was to this type of work, and between 1853 and 1856 he assisted in the construction of fortifications at Dry Tortugas, Fla., at the mouth of the Savannah River, and at Charleston, S.Car. During the Civil War he must have followed with mingled feelings the long naval seige of the latter port!

Whenever the opportunity offered, Craighill put in a word for coast defenses. His Convention address as President of the Society, in fact, was devoted to the subject, and in view of the current discussion of national defense it may be of interest to quote it at some length:

"When the great Civil War came on," he said, "the sea-coast defenses of this country, so far as the system had been carried out, were admitted to be as good as any in the world." But for many years since then, he added, nothing had been done by the United States either on fortifications or for the Navy, and in 1894 we were far behind European nations. Some seemed to think "that we need neither forts nor ships, that no enemy would undertake to land an army on our shores, as our militia would rise up and drive the invaders into the ocean or capture them all.

"The people holding such opinions are generally those who dwell in the interior and are little likely to be attacked by anybody . . . . In the case of an attempt at a descent upon our coast, a proper resistance could not be made by the militia alone—the more men lined the shores, armed with the best rifles and with field artillery, the greater would be the slaughter, and disaster . . . .

"For security against invasion, we must have something more than the army to depend upon. We need something to keep an enemy's ships carrying the largest long-range guns, at such a distance from our vulnerable points as to have them secure . . . .

"We might resort to the most obvious method, to fill up the channels of approach by such obstructions as would prevent our enemy from getting at us. But this would excite the derision of the world, would not be worthy of a brave people, and would . . . destroy our own commerce, one of the first objects the enemy himself would desire."

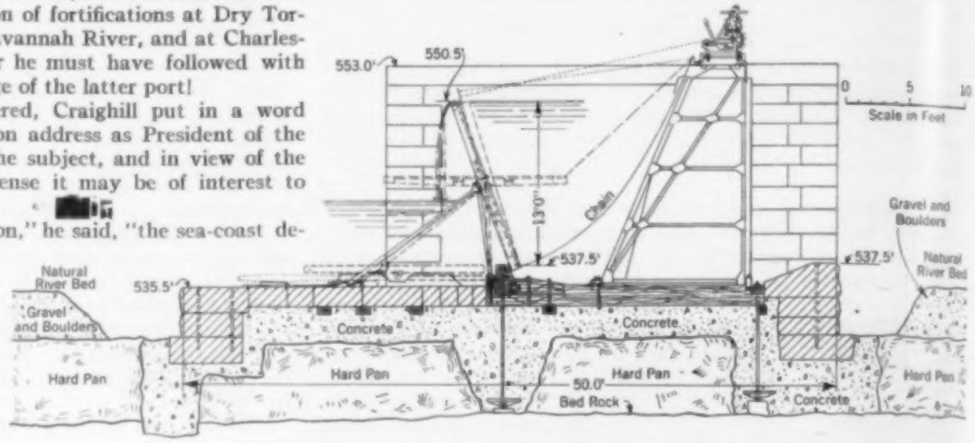
It would be impossible to depend on the Navy alone for defense. To protect the immense coast line of the United States "would take a navy greater than that of all the other nations of the world combined . . . . We can never expect to have a navy one-twentieth as large as that. And it would not seem fair or right, even if we had such a navy, to tie it down to the purposes of coast defense, when its power of mobility enables it to take the more imposing duty of going after the enemy, fighting him where he is to be found, and compelling him to keep near his own possessions for their defense."

A year after this address, Craighill was promoted to the post of Chief of Engineers. By his personal efforts he aroused the interest of the Secretary of War and of Congress in the building of coast defenses, to such an extent that Congress made the first large appropriations in years for that purpose. Thus it fell to his lot to begin the work on the present system.

Due to his insistence, the development of the disappearing carriage for 12-in. guns was hastened by the Ordnance Department, thus permitting the abolition of the very expensive lift type of battery, which until then was the only type affording protection for such large guns during loading. He also changed the type of the mortar batteries, and had important improvements made in the submarine mine system.

Craighill retired from active service at his own request in 1897. Except for work as a member of the board of consulting engineers of the Dock Department of the city of New York, his retirement ended his active career as an engineer. He died at Charleston, W.Va., the town of his birth, on January 18, 1909.

The writers of his Memoir (TRANSACTIONS, 1909) refer particularly to his work with the Society, and state that he was a business executive of the first order. He was attentive to trivial details, when such details appeared to have an ultimate bearing of importance; however, "when no subsequent advantage was apparent, he was perhaps unequaled in his ability to side-track such matters" without appearing brusque or offensive. "As is frequently the case where routine matters must be passed upon by a board composed



THE FIRST MOVABLE DAM IN THE UNITED STATES
Section of Chanoine Wicket Structure on Kanawha River (1880)

of many men, the tendency is to fritter away time to no useful purpose. Early in the General's service as a Director it was made evident that he had little in common with such discussions, and could confidently be counted on to 'vote first and talk afterward.'"

Craighill was twice married, and his family consisted of three sons and three daughters. One of the sons, William E. Craighill, was graduated second in the class of 1885 at the U. S. Military Academy, entered the Corps of Engineers, and served in the Spanish-American War as a major.

This sketch may well conclude with the General's own estimate of his honors and achievements. By his expressed instructions, the following inscription was to be cut on his tombstone:

William Price Craighill

Brigadier-General and Chief of Engineers,
United States Army;
Honorary Member and Past-President,
American Society of Civil Engineers.

Manual on Surveying Terms Issued

MANUAL No. 15, a 24-page booklet containing definitions of more than 200 surveying terms, has just been distributed by mail to the entire membership of the Society. "Definitions of Surveying Terms" is the work of a committee of the Surveying and Mapping Division, headed originally by the late Prof. George L. Hosmer, and since his death by Prof. Charles B. Breed. The third member of the committee is Prof. John W. Howard. Many other persons, however, have contributed to the definitions in their final form, for in 1932 the committee's preliminary report was widely circulated, in mimeographed form, for revisions and additions, and as a result of this procedure a large amount of new material was received.

The present Manual makes no pretense of being "complete"; it is designed for service, not for bulk, and with few exceptions the terms defined are those that have been found to need clarification. Subjects having a terminology of their own, such as "Least Squares," have in general been omitted. However, definitions of a large group of terms dealing with photographic mapping, and of some concerned with photography itself, were deemed essential, and their inclusion should be welcomed.

The final editing and styling, as well as the mechanical details of preparing printer's copy and proofreading, were handled by the regular PROCEEDINGS staff, at Society Headquarters, and the mailing was handled at the same office. It is interesting to note that the entire edition of over 15,000 copies was placed in the mails the same day it was received from the printer. This was made possible by addressing the envelopes and sorting them in accordance with postal regulations in advance, and throwing a large part of the clerical force onto the job of "stuffing" as soon as the Manuals arrived.

Board Commemorates Late C. Arthur Poole

At its January meeting the Board assembled for the first time without Director C. Arthur Poole, who was constant in his attention to Board matters during the three years of his service. His death occurred only a few days after his attendance at the Boston Meeting in October.

Commemorating this faithful service, and expressing its personal feeling of loyalty to his fine character, the Board unanimously adopted the following resolution:

"Whereas the Board of Direction of the American Society of Civil Engineers has been shocked to learn of the death on October 14, 1937, of its fellow Director, C. Arthur Poole; and

"Whereas he has been most interested in the affairs of the Board, and faithful in his attendance at its meetings; and

"Whereas the Society has lost a valued member and representative in its national and local affairs,

"*Now, therefore, be it resolved* by this Board assembled in meeting at New York City this day, January 18, 1938, that it records its sincere regard for its late associate and its deep respect for his sterling character; that it extends to his family its sympathy and directs that this resolution be made a part of its official minutes and that a copy be forwarded to Mr. Poole's family."

Minutes of Business Meeting, January 19, 1938

At the Eighty-Fifth Annual Meeting of the Society, provision was made at the first session, on Wednesday morning, January 19, for a regular business meeting.

A report was received from R. E. Bakenhus, chairman of the committee to which was referred, by official action of the Society Convention at Detroit in July 1937, the question of an amendment to the Constitution, Article VII, Sections 1 and 3, relating to the "Nomination and Election of Officers." This amendment, known as "Proposal No. 4," was analyzed in a three-page report. As a result of its study, the committee proposed that this amendment be sent to letter ballot to all Corporate Members "with the recommendation that it be not approved." After a considerable discussion, motion to this effect was carried.

Under regular procedure, Amendment to the Constitution, Article VII, Section 1, designated "Proposal No. 5," was then presented to the meeting, this also dealing with nomination and election of officers. After discussion, the wording of this proposal was amended so that the last two sentences may read:

"Each member shall be allocated as resident in the district within which his mailing address of record with the Society on the preceding January 1st is located. Members not residing in North America shall be allocated as resident in District No. 1; the Board of Direction, however, may allocate any member, with his consent, as resident of such other district as in its discretion, it shall designate."

By show of hands this amended wording was approved—110 favorable, 52 opposed. Further as to proposal No. 5, it was duly voted that the President appoint a committee to report in July, at the Salt Lake City meeting, on this proposal as amended, this committee to avail itself of legal advice.

Continuing this same line of thought, a motion was adopted that it be the distinct understanding of the meeting that every member residing outside of North America has the privilege of choosing the district to which he shall be allocated, and that he shall be so allocated provided it meets with the approval of the Board of Direction; and that his allocation take effect on January 1 following such request.

This action concluded the business at the Eighty-Fifth Annual Meeting.

Freeman Scholarship Open

Announcement is made by the Society that applications will shortly again be received for the Freeman Traveling Scholarship in hydraulics. Made possible through the generosity of the late John R. Freeman, Past-President and Honorary Member of the Society, this scholarship provides for a year's study in European hydraulic laboratories. Awards have been made to ten recipients in the past.

Applicants for the scholarship must be American citizens between 24 and 35 years of age. They must have graduated from a technical school of recognized standing, and should have the professional status of a junior teacher. Membership in the Society is considered advantageous. In addition, applicants should be well grounded in mathematics and the mathematical treatment of hydraulic problems. They should preferably have had experience in hydraulic design and construction, and should have had a good grounding in the German language. Further details as to qualifications and method for making applications will be found in a mimeographed copy of the conditions of the award, which may be obtained on request from Society Headquarters.

The last day for filing an application will be June 15, 1938, and the award will be made by the Committee on the Freeman Fund on or before July 1. In view of the fact that considerable work will be entailed in providing the necessary information and references, candidates should lose no time in making application.

Society Business Meeting to Be Held March 16

A regular business meeting of the Society will be held in the Engineering Societies Building, 33 West 39th Street, New York, N.Y., on the evening of March 16, 1938, at 8 p.m. The purpose of the meeting is to canvass the ballots on the proposed amendment to the Constitution. This announcement is made in compliance with the requirement of the Constitution that Corporate Members shall receive official notice 15 days in advance of the meeting.

The business meeting, called solely for the purpose stated, will immediately precede the regular monthly meeting of the Metropolitan Section of the Society.

Districts and Zones Unchanged

As noted elsewhere in this issue, the Board of Direction, at its meeting on January 17, 1938, confirmed the boundaries of the Districts and Zones into which the membership of the Society has been divided, retaining the same division as that in force since January 1931. This statement is published in order to conform to the requirements of the Constitution, Article VII, Section 1—that the boundaries of both Districts and Zones shall be announced to the Corporate Membership not later than April 1 in each year.

Student Chapters Win Commendation

For some years it has been the practice for the Board of Direction to award letters of commendation, signed by the President, to specially selected Student Chapters, on recommendation of the Committee on Student Chapters, for meritorious work during the previous year. The basis of the award is the record of the Chapters principally as recorded in their annual reports. The Chapters themselves have shown a great interest and as a result the committee has noted progressively improving records and distinct advances in the activities and success of the Chapters themselves. Such has been the appeal of these awards that Chapters have frequently asked, "What should we do to merit the award of one of these commendatory letters?"

Upon recommendation of the committee, the Board at its January meeting gladly approved the granting of an individual "Letter of Commendation" to each of the following Student Chapters, arranged in four geographical groups:

Columbia University	University of Dayton
Cornell University	University of Illinois
Drexel Institute of Technology	University of Minnesota
Johns Hopkins University	Kansas State College
University of Kentucky	Stanford University
Tulane University	University of Wyoming

It should be noted that Tulane University, the University of Illinois, and Kansas State College are being thus honored for the third consecutive year.

American Engineering Council

The Washington Embassy for Engineers, the National Representative of a Large Number of National, State, and Local Engineering Societies Located in 40 States

Public Works Administration

Officials report that PWA has no funds for either grants or loans and does not expect to have any unless Congress and the Administration should decide to appropriate more money for financing emergency construction for "pump priming" or "employment purposes." PWA insists that it is busily engaged in finishing all projects for which allotments have already been made and that it expects to go out of business. A large portion of the work is scheduled to be completed before June 30, 1938.

Since the Farm Security Administration, which is the new name for what is left of the Resettlement Administration, is almost entirely out of the construction business, the emergency construction of public works seems about to be left in the hands of WPA. In the meantime, it is evident that many of those engineers and their associates who are handling public works and emergency construction must find other work within the next few months.

It seems easier to talk about cutting down public works expenditures than to do it in the face of a "recession" or "depression." Engineers may well advise with public officials regarding ways and means for doing essential public works, and may lend encouragement to those in public office who are struggling to find solutions to these problems.

Housing Developments

The latest development in housing has to do with construction of large housing projects as well as small residences. The Federal Housing Administration is prepared to guarantee the mortgages up to 80 per cent on the larger undertakings and as much as 90 per cent on residences which do not cost more than $6,000. The following excerpts are taken from a summary of FHA releases to members of its own organization.

The Federal Housing Administration program under the amended law, signed by President Roosevelt on February 3, 1938, is designed to assist families of moderate means to obtain adequate and decent housing on the most favorable terms in the history of the country. The Housing Administration is authorized to insure a total of $2,000,000,000 outstanding at any one time, and with the approval of the President this amount may be increased to $3,000,000,000.

FHA Small Homes Financing

The total maximum annual carrying charge for an FHA insured mortgage on which a commitment is issued hereafter will be $5^1/_2$ per cent. This will include 5 per cent interest and one-half of one per cent mortgage-insurance premium. In the case of newly constructed homes securing mortgages not exceeding $5,400, and meeting certain other conditions, the premium rate will be one-fourth of one per cent, making the total annual carrying charge to the borrower $5^1/_4$ per cent.

The annual service charge of one-half of one per cent which the lending institutions have been permitted to charge under FHA regulations will be discontinued on all mortgages for which a commitment to insure is issued hereafter. The insurance premium in the future will be based upon the outstanding balance instead of the original face value of the mortgage as provided in the old law.

On newly constructed houses appraised at $6,000 or less, the minimum permissible down payment or equity requirement will be reduced from 20 per cent to 10 per cent. On newly constructed houses appraised at $10,000 or less, the insurable limit will be 90 per cent of the appraised value up to $6,000 plus 80 per cent of the appraised value above $6,000. On all other homes housing from one to four families, the insurable mortgage limit will remain at 80 per cent of the appraisal value, but not in excess of $16,000 under any circumstances.

FHA Multi-Family and Group Housing

The Federal Housing Administration large-scale housing program should not be confused with the slum-clearance program of the U. S. Housing Authority. It is aimed primarily to promote the construction of housing facilities for wage earning and salaried families who by preference or necessity live in rented dwellings. According to the 1930 census, approximately 56 per cent of all urban families in the United States occupied rented dwellings. The 93 cities of 100,000 and over range in the proportion of renting families from a high of 78.6 per cent for New York City to a low of 37.3 per cent for Tacoma, Wash.

The multi-family and group housing program is designed to promote construction of large-scale projects covered by mortgages up to $5,000,000 and of smaller developments covered by mortgages ranging from $16,000 to $200,000.

An important feature of the new program is the provision for insuring mortgages not only on multi-family structures, but also upon developments consisting of single-family houses. These mortgages will be insured up to 80 per cent of the appraised value of projects, provided that in the case of large-scale developments the amount may not exceed $1,350 per room; and in the case of the smaller developments, $1,150 per room. The mortgage-insurance premium will be charged at the rate of one-half of one per cent annually on the outstanding principal of the mortgage.

FHA Modernization and Repair Program

Notices have been sent to 7,000 lending institutions throughout the United States authorizing them to begin making modernization and repair loans under Title I of the amended Act.

Persons, partnerships, and corporations are eligible to borrow money under the modernization-and-repair credit plan. The borrower must have an assured income, demonstrate his ability to repay the loan, and own the property to be improved or have a lease on it running at least six months longer than the term of the loan.

Amounts up to $10,000 may be borrowed to repair or improve existing structures, and amounts up to $2,500 may be borrowed for the erection of new structures. If the loan is made for the purpose of building a new home, security will be required in the form of a mortgage or deed of trust covering the property improved. In addition, there will be certain general construction requirements which will assist in protecting the investment of the home owner.

The provision for these new homes costing not in excess of $2,500 under Title I should not be confused with the plan of home ownership sponsored under Title II of the Act. The facilities afforded under Title I are intended primarily for those citizens who live on farms, in rural areas, or in the marginal

Forecast for March "Proceedings"

Natural Periods of Uniform Cantilever Beams
by Lydik S. Jacobsen, Esq.
A theoretical study of cantilevers subjected to shear as well as to flexure, with elastic restraint at the embedded end.

Some Practical Methods of Re-Zoning Urban Areas
by Hugh E. Young, M. Am. Soc. C.E.
Argues for the re-zoning of American cities from data pertaining to trends and experiences in Chicago, Ill.

Pin-Connected Plate Links
by Bruce Johnston, Assoc. M. Am. Soc. C.E.
Report of an experimental research, describing the results of 106 tests of stresses in steel plates.

Water Supply Engineering
The 1937 Progress Report of the Sanitary Engineering Division describes "the state of the nation" as to its water supply, covering every factor from a drink of water to the construction of dams, and from laying a water pipe to the manufacture of cement.

Masonry and Reinforced Concrete
This year's report of the Committee of the Structural Division on Masonry and Reinforced Concrete is concerned entirely with moments in flat slabs of various types, as prepared by one of its subcommittees.

zone surrounding the larger cities where the standards established by the mutual mortgage-insurance system are not applicable.

Eighteenth Annual Assembly of Council

At the Eighteenth Annual Assembly of American Engineering Council, held in Washington, D.C., on January 13–15, 1938, official representatives of 53 engineering organizations sat as one body to discuss seriously problems of mutual concern to all organized engineering.

An exchange of opinions and experiences between secretaries of the engineering societies of the United States held the attention of the group for one of the three days. A score or more of secretaries of national, state, and local societies sought more effective means for serving their memberships through a discussion covering everything from the simplification of office routine to the construction of meeting programs and provisions for the management of employment and other important services.

Speaking before the Eighth Conference of Engineering Secretaries, President Andrey A. Potter of Council expressed the opinion that "engineering societies in any state will do well to relate their members to the public questions of their particular commonwealth by perfecting suitable state engineering organizations. Such state groups should prove influential in making known to those who are directing the state government, engineering thinking and engineering opinions on public matters. In our larger metropolitan centers, city engineering federations or public-affairs committees of local engineering clubs prove helpful. State and local engineering councils or public-affairs committees, composed of representatives from existing engineering organizations, can enhance the public esteem for their profession."

Four major themes occupied the attention of the representatives on the second and third days. The first was concerned with the engineers' economic status, and resulted in a recommendation that the executive committee continue the collection, analysis, and distribution of factual information for the welfare of the profession. Under the second theme—the evaluation of technology—representatives expressed the belief that ways and means should be found to increase the public understanding of the value of research and technology as a basis for increased employment and national wealth. In the third theme, that of planning public and private enterprise, the discussion emphasized the opportunity of local engineering groups to participate in local and state planning movements. Government reorganization constituted the fourth general theme, and the Assembly voted to continue its approval of a Department of Public Works and its support of the merit system. Supplemental discussions included consideration of the engineer's relation to national defense, the need of dramatizing the work of the engineer in public affairs, and the approval of reports of Council's standing and special committees.

Satisfaction was expressed by the representatives of the member organizations that Council provides a common denominator which affords the opportunity for engineers from all branches of the profession to present a united front on public affairs and on questions involving public service.

Council's Official Family

January 15, 1938, marked the successful closing of another eventful year in Council's history and the beginning of a new president's administration. Dean A. A. Potter completed a term of two vigorous years as president and chairman of the executive committee, during which nine societies joined the "organization of engineering organizations." Mr. Charles E. Stephens finished his fourth year as treasurer and member of the executive committee. Mr. Stephens asked to be relieved of that responsibility, after having managed Council's financial affairs through some of the most difficult years in its history.

Dr. William McClellan of Washington, D.C., was unanimously elected president of Council for a period of two years beginning January 15, 1938. In like manner, Mr. L. J. Fletcher was elected treasurer for 1938. Without opposition, Messrs. Ralph E. Flanders and Alonzo J. Hammond were reelected vice-presidents for two-year terms beginning January 15, 1938. Vice-Presidents C. O. Bickelhaupt and John S. Dodds' terms do not expire until the conclusion of the next annual meeting in January 1939. Executive Secretary F. M. Feiker was unanimously reelected for 1938.

The elected officers and the chairmen of the finance committee, membership and representation committee, and public affairs committee constitute the executive committee, which was authorized by resolution to act for both the administrative board and the assembly during 1938 and until the beginning of the nineteenth annual meeting of the assembly in January 1939. The executive committee, headed by President McClellan, expects to announce appointments of the chairmen of these committees at an early date.

Washington, D.C.
February 9, 1938

Can the Joke Be on the Camel?

Some of the demon proofreaders among Society members have taken an ill-concealed delight in drawing the editors' attention to the description of certain methods of adapting illustrations for use in Civil Engineering, as given in the January 1938 issue under the title, "Art Helps Photography." These eagle-eyed critics call special note to the reference there given to "a camel's hairbrush." They will not even accept excuses as to typographic errors, omission of word separation, "correct in the printer's copy," and similar justifiable reasons. All they know is what they see in type. So, as usual, the editors have to "take the rap."

News of Local Sections

Scheduled Meetings

Buffalo Section—Luncheon meeting at the Buffalo Athletic Club on March 8, at 12:15 p.m.

Central Ohio Section—Luncheon meeting at the Chittenden Hotel on March 17, at 12 m.

Cleveland Section—Luncheon meeting at the Chamber of Commerce on March 8, at 12:15 p.m.

Colorado Section—Dinner meeting at the University Club, Denver, on March 14, at 6:30 p.m.

Iowa Section—Evening meeting in Iowa City on March 8, at 8 p.m.

Kentucky Section—Meeting in Louisville on March 15.

Los Angeles Section—Dinner meeting at the University Club on March 9, at 6:15 p.m.

Metropolitan Section—Technical meeting in the Engineering Societies Building, New York, on March 16, at 8 p.m.

Oklahoma Section—Joint meeting with Student Chapters in College Cafeteria Annex in Stillwater on March 26, at 6:30 p.m.

Philadelphia Section—Dinner and regular meeting at the Engineers Club on March 16, at 6 p.m. (meeting 7:30 p.m.)

Pittsburgh Section—Joint meeting with Engineers Society of Western Pennsylvania at the William Penn Hotel on March 25, at 8 p.m.

Sacramento Section—Regular luncheon meetings at the Elks Club every Tuesday, at 12:10 p.m.

St. Louis Section—Luncheon meeting at the Mayfair Hotel on March 28, at 12:15 p.m.

San Diego Section—Regular meeting on March 24.

San Francisco Section—Dinner meeting of the Junior Forum on March 22, at 6 p.m.

Seattle Section—Joint dinner meeting of the Four Founder Societies at the Arctic Club on March 8, at 6:30 p.m.

Spokane Section—Luncheon meeting at the Crescent Tea Room on March 11, at 12 m.

Tacoma Section—Dinner meeting at the Lakewood Community Center on March 8, at 6:45 p. m.

Tennessee Valley Section—Dinner meeting of the Knoxville Sub-Section at the University of Tennessee Cafeteria on March 3, at 6:15 p.m.

Texas Section—Luncheon meeting of the Dallas Branch at the Dallas Athletic Club on March 7, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel on March 12, at 12 m.

Recent Activities

Alabama Section

The annual meeting of the Alabama Section took place in the Thomas Jefferson Hotel in Birmingham on January 31 immediately after a joint meeting with the Birmingham section of the Association of Iron and Steel Engineers. The speaker at the joint session was A. C. Polk, consulting engineer of Birmingham, whose subject was "The Birmingham Industrial Water Supply." His talk was illustrated by slides showing various phases of the work being done on that project. Several business matters were discussed at the annual meeting, and officers were elected for the coming year. These are E. E. Michaels, president; Roy S. Garrett, vice-president; and R. D. Jordan, secretary-treasurer.

Buffalo Section

About 70 members of the Buffalo Section met for luncheon at the Buffalo Athletic Club on January 14. After the usual business discussion the speaker of the occasion, Lt. Col. Edwin H. Marks, was introduced. Colonel Marks, who is district engineer in the U. S. Engineer Office at Buffalo, spoke on "Some Historical Aspects of Military Engineering." On January 18 the Section cooperated with the Engineering Foundation of Buffalo in sponsoring a talk by Lawrence D. Bell, president of the Bell Aircraft Corporation. The attendance at the lecture was 350. The February luncheon meeting took place at the Buffalo Athletic Club on the 8th, with 40 present. An interesting technical program had been arranged, but at the last moment both speakers were unavoidably detained, so a business meeting occupied the entire session.

Central Ohio Section

On January 20 a luncheon meeting of the Central Ohio Section took place at the Chittenden Hotel. The guest speaker was James Slayter, director of research for the Owens-Illinois Glass Company Research Laboratories at Newark, Ohio. Dr. Slayter, who has been prominent in the development of the glass textile material used in the electrical industry, covered in a general way the phases of the industry of special interest to civil engineers. An unusually large attendance was present.

Cincinnati Section

A joint meeting of the Cincinnati Section of the Society and the Engineers Club of Cincinnati was called to order on January 20. There were 100 present on this occasion to hear the guest speaker, William F. Clapp, consulting biologist of Duxbury, Mass., discuss the subject of insects destructive to timber. This address aroused considerable interest, and an enthusiastic discussion followed. At the conclusion of the meeting there was a buffet supper provided by the Engineers Club.

Cleveland Section

The annual meeting of the Cleveland Section, held in the club rooms of the Cleveland Chamber of Commerce on January 17, was enjoyed by a group of students, members, and guests totaling more than 100. Following a banquet, these officers were elected to serve for the coming year: Frank L. Gorman, president; Frank C. Tolles, vice-president; and G. Brooks Earnest, secretary-treasurer. The reports of officers and committees were read and accepted, and certificates of life membership in the Society were presented to 14 members of the Section. Then Willard T. Chevalier, vice-president of the McGraw-Hill Publishing Company, addressed the meeting on "The Engineer and the New Frontiers." At the conclusion of this unusually interesting meeting the retiring president, Arthur F. Blaser, introduced the new officers and handed the gavel, symbol of his office, to his successor.

Colorado Section

Planning was the topic considered at a meeting of the Colorado Section, held at the University Club on November 8. The first speaker on the program was Lt. R. J. Bellerby, recruiting officer for the U. S. Navy at Denver, who presented a paper by Walter H. Allen, captain, C.E.C., U. S. Navy, on "The Need of a Civil Engineer Corps Reserve." A talk was then given by Dean Peterson, of the University of Colorado. Dean Peterson, who is also a member of the State Planning Commission of Colorado, discussed the duties, policies, and objectives of the Commission. Both talks emphasized the need of planning for the future. On January 10 members of the Section met at the University Club for dinner and a motion picture of the construction of the Golden Gate Bridge. The film, which was furnished by the Bethlehem Steel Company, was obtained through the courtesy of J. E. Ross, local representative of the company.

On December 6 the Junior Association of the Colorado Section held an informal dinner meeting in honor of J. C. Stevens, consulting hydraulic engineer of Portland, Ore. After dinner and a brief business session Mr. Stevens was introduced by L. G. Smith, chairman of the program committee. Mr. Stevens, who is a member of the National Resources Committee and regional consultant for the Colorado River basin, outlined the organization and work of the Committee. There were 24 present.

Dayton Section

There were 25 present at the annual luncheon meeting of the Dayton Section, which took place at the Engineers Club on December 20. The program featured the presentation of a certificate of life membership in the Society to F. J. Cellarius, the first member of the Section to be thus honored. The certificate was presented by B. T. Schad, retiring president, and acknowledged by Mr. Cellarius. Then the Reverend Dr. Joseph Trunk, professor of sociology at the University of Dayton, gave a talk on "The Relation of the Civil Engineer to Civilization." The Section officers for 1938 are as follows: E. O. Brown, president; G. V. Clow, first vice-president; J. J. Chamberlain, Jr., second vice-president; and C. H. Stephens, secretary-treasurer.

There were 27 present at the regular scheduled luncheon meeting of the Dayton Section, held at the Engineers Club on January 17. The aims and activities of the Section for 1938 were discussed at some length, and a committee was appointed to take under advisement any plans and submit a report. An authorized U. S. Navy sound motion picture showing navy maneuvers was also enjoyed.

Detroit Section

A meeting of the Detroit Section was held at the Hotel Statler on December 17, with 112 present. The principal speaker was Clarence W. Hubbell, consulting engineer of Detroit, whose topic was "The Background and Development of Detroit's Sewage Disposal Project." For more than twenty-five years Mr. Hubbell promoted this project, which is now well under way. Others on the technical program were Edward D. Rich, engineer of the Michigan Department of Health, who discussed the subject from the standpoint of health, and Leo V. Garrity, engineer in charge of construction, who described views showing the progress of construction. A social hour followed the meeting. On January 3 members of the Detroit Section held a joint session with the Lansing Engineers Club at East Lansing. Following dinner and an exchange of greetings, several speakers were heard on the technical program. These included James H. Cissel, professor of structural engineering at the University of Michigan, and Varnum B. Steinbaugh, deputy commissioner and chief engineer of the Michigan State Highway Department.

District of Columbia Section

The District of Columbia Section has elected the following officers for 1938: Daniel C. Walser, president; Winchester E. Reynolds, vice-president; and C. A. Betts, secretary-treasurer.

The traditional annual January dinner meeting of the District of Columbia Section brought 140 members and guests together at the Washington Hotel in Washington on January 26. The opportunity to meet President Riggs and Secretary Seabury as well as other Society officers, who arrived in time for an informal luncheon at the Cosmos Club and conference at American Engineering Council, added to the enjoyment of the occasion. Following dinner the past and present officers were introduced, after which Secretary Seabury discussed Society publications, and President Riggs spoke on various timely matters. The other speakers were L. R. Lohr, President of the National Broadcasting Company, whose topic was the future of radio, and Senator O'Mahoney, who discussed corporations, the states, and their relation to the nation.

Duluth Section

Officers for the Duluth Section for 1938 were elected at a meeting held on January 17. The list of these is as follows: A. B. Jones, president; R. M. Palmer, first vice-president; W. H. Woodbury, second vice-president; William E. Hawley, secretary; and John Carson, treasurer.

Illinois Section

During the past few months the Juniors of the Illinois Section have enjoyed several meetings. In October they heard F. W. Herring, executive director of the American Public Works Association, speak on "The Engineer in Public Life." The speaker at the November session was G. W. Hand, who discussed the problems facing American railroads. At the December meeting H. P. Ramey and L. W. Hall, assistant chief engineer and hydraulic engineer, respectively, for the Sanitary District of Chicago, discussed the design and operation of the control works and lock that are being built by the Sanitary District at the mouth of the Chicago River. At a meeting held on January 31 the Juniors elected the following officers for the ensuing year: E. W. DeBerard, president; J. A. Leadabrand, vice-president; E. P. Cranley, secretary; and J. E. Goldberg, treasurer. The speaker of the evening was Walter H. Klapproth, district traffic engineer for the state of Illinois. His subject was "The Engineering Approach to Traffic Safety."

Lehigh Valley Section

On December 16 the Lehigh Valley Section held its annual meeting at the Old Sun Inn in Bethlehem, Pa. Secretary Seabury presented certificates of life membership in the Society to the following: L. E. Johnson, G. H. Blakeley, R. E. Neumeyer, C. H. Mercer, C. I. Bausher, B. C. Collier, and L. J. H. Grossart. At the end of the year three more names—S. W. Bradshaw, J. McNeal, and F. C. Stehle—were added to the list. The guest speaker was C. E. Myers, Director of the Society, who gave a talk on the registration laws and the civil engineer. The annual election of officers held at this time resulted as follows: Jonathan Jones, president; George F. Roehrig and L. P. Grossart, vice-presidents; and M. O. Fuller, secretary-treasurer.

Los Angeles Section

There were 186 members and guests present at the January dinner meeting of the Los Angeles Section, which was held at the University Club on the 12th. The speakers on the technical program included Raymond A. Hill, Director of the Society, who described the physical and geological characteristics of the Elysian Park slide; Richard B. Ward, resident engineer on the Cajalco Dam of the Metropolitan Water District of Southern California, who discussed the general design and construction features of the Cajalco Dam; and N. F. Crossley, assistant engineer and soil technician for the Metropolitan Water District, who explained the soil mechanics methods used in the construction of the Cajalco Dam. The two latter talks were illustrated with lantern slides.

The Junior Forum of the Los Angeles Section met on the same evening. The feature of this occasion was a talk by Charles K. Lewis, district safety engineer for the U. S. Engineer Office, who spoke on safety in construction work, illustrating his remarks with lantern slides.

Louisiana Section

At the annual meeting of the Louisiana Section, held in New Orleans on January 26, the following officers for 1938 were elected: William H. Rhodes, president; A. J. Negrotto, first vice-president; Norman E. Lant, second vice-president; and J. A. McNiven, secretary-treasurer. Certificates of life membership in the Society were presented to George G. Earl, J. Frank Coleman, and George Derby. The technical program consisted of a talk by George P. Rice, consulting engineer of New Orleans, who discussed the foundation, design, and construction of the main building of the New Orleans Charity Hospital. A smoker and social hour concluded the evening.

Maryland Section

The Maryland Section of the Society reports the election of the following officers for 1938: Abel Wolman, president; Alfred H. Hartman, vice-president; and John J. Jenkins, Jr., secretary-treasurer.

Metropolitan Section

The extension of the West Side Express Highway, a project now nearing completion in New York City, was the subject of an illustrated paper by Emil Praeger, consulting engineer of New York, at the meeting of the Metropolitan Section on February 16. This extension, which connects with the Westchester parkway system, is of general interest not only because of its size, but because of the unusual variety of complicated problems its construction has involved. About 400 persons attended the meeting.

At the February 9 meeting of the Junior Branch, Bruce Johnston, instructor in civil engineering at Columbia University, presented a moving-picture record of his recent trip to Africa. In addition to technical features, the pictures included picturesque scenes taken in the jungle and in native villages.

North Carolina Section

On January 29 the North Carolina Section held a technical meeting in Raleigh. A number of Student Chapter members were included in the total of 44 present. The speakers were B. R. Van-Leer, dean of engineering at North Carolina State College, who discussed the subject of engineering curricula in the technical schools of today; William M. Piatt, consulting engineer of Durham, whose topic was "Drainage Basin Studies"; and Harold C. Bird, professor of civil engineering at Duke University, who discussed the territorial limits of the North Carolina Section. During the meeting J. D. Spinks made a memorial speech in tribute to John L. Becton, who died on January 8 while serving as president of the Section. G. H. Maurice will be acting president until May when Mr. Becton's term would have expired.

Northeastern Section

An interesting and varied program characterized the annual meeting of the Northeastern Section, which was held in Boston on January 24. Following dinner, certificates of life membership were presented to 14 members of the Section. Another feature of the business session was the annual election of officers, which resulted as follows: J. P. Wentworth, president; S. M. Ellsworth, vice-president; and F. H. Kingsbury, secretary-treasurer. The president then presented Henry E. Riggs, newly elected president of the Society, and George T. Seabury, secretary. In his talk Professor Riggs addressed himself particularly to the younger men present and indulged in personal reminiscences of his start in the engineering profession. Mr. Seabury stressed the interest of the Society in activities pertaining to the welfare of the profession and the improvement of the economic status of the engineer. Other speakers were Arthur W. Dean and Frank A. Barbour, respectively, Director and retiring Director of the Society. The technical program consisted of a talk by Arthur Casagrande, assistant professor of civil engineering at the Harvard Graduate School of Engineering, who gave an illustrated lecture on the new automobile roads in Germany. A few brief remarks made by Mr. Wentworth, the incoming president, concluded the evening. There were 123 present.

Northwestern Section

There were 30 members and guests present at a meeting of the Northwestern Section held at the Minnesota Union in Minneapolis, on January 11. Following dinner and a brief business session, James L. Ferebee, chief engineer of the Milwaukee Sewerage Commission, gave an interesting account of the development of sewage-disposal methods in Milwaukee. As a Director of the Society, Mr. Ferebee also discussed Society affairs of interest.

Philadelphia Section

A symposium on water policies and resources was enjoyed at the January meeting of the Philadelphia Section, which was held at the Engineers Club on the 13th. Preceding the technical program, a short talk on the publications of the Society was given by Sydney Wilmot, manager of publications. After brief introductory remarks by W. H. Chorlton, president of the Section, and Isaac S. Walker, chairman of the meeting (who has since died), the first technical speaker was introduced. This was Thorndike Saville, dean of the college of engineering at New York University, whose talk included an outline of the major acts of Congress in regard to water supply enacted during the past fifty years. The other speakers in the symposium were Nathan B. Jacobs, president of Morris Knowles, Inc., consulting engineers of Pittsburgh, Pa.; John C. H. Lee, district engineer of the Philadelphia Engineer District; W. L. Stevenson, former chief engineer of the Pennsylvania State Department of Health; and Howard T. Critchlow, engineer in charge of the State Water Policy Commission of New Jersey. Following this program of scheduled speakers, Prof. William S. Pardoe led an informal discussion. At the conclusion

of the meeting refreshments were served. There were 150 at the meeting and 85 at the dinner preceding it.

Portland (Ore.) Section

Thirty Student Chapter members from Oregon State College were among the 85 present at the February 3d meeting of the Portland (Ore.) Section. Because of the length of the program all business discussion was postponed. The first speaker was Louis C. Hill, Past-President of the Society, who spoke briefly of a recent European trip. Next, L. F. Harza, consulting engineer of Chicago, described a trip through Mexico over the new Pan-American Highway, emphasizing aspects of engineering interest. The final speaker on the program was W. P. Creager, consulting engineer of Buffalo, N.Y., who reviewed the development of various types of dams during the past fifteen years and outlined the program of the Soil Mechanics and Foundations Division of the Society. After an informal discussion light refreshments were served.

Providence Section

The Providence Section held a dinner and meeting on January 25, with 25 at the dinner and more at the meeting following it. The two guest speakers were President Riggs and Secretary Seabury. The former gave a brief talk on the growth and development of the Society, while Mr. Seabury discussed the problems facing engineers. He also explained the new method of annual allotment to the Sections. Charles L. Pool, sanitary engineer and chemist for the Rhode Island State Department of Public Health, was the principal speaker of the evening. He discussed the relationship of dust to industrial diseases and also spoke on matters of Society interest.

Puerto Rico Section

At its annual meeting, which took place on December 14, the Puerto Rico Section elected the following officers for 1938: Francisco Pons, president; Juan M. Bertran and Adriano Gonzales, vice-presidents; and Francisco Fortuno, secretary-treasurer.

Sacramento Section

On January 11 the Sacramento Section held a regular meeting, at which the following officers were elected for the year 1938: Norwood Silsbee, president; Oswald Speir, second vice-president; and Mark S. Edson, secretary-treasurer. Paul S. Jones, second vice-president for 1937, automatically becomes first vice-president for 1938.

San Diego Section

The San Diego Section recently passed a resolution urging adequate appropriations to permit the U. S. Coast and Geodetic Survey and the U. S. Geological Survey to proceed with a comprehensive program of mapping the United States, with particular attention to southern California. Copies of this resolution were forwarded to Senator McAdoo and Representative Izac.

San Francisco Section

On January 12 the San Francisco Section participated in a joint meeting of the Four Founder Societies. There were 160 at the dinner preceding the meeting, while 470 gathered to hear the topic of the evening—"air conditioning"—discussed. A technical talk was given by Dr. Baldwin M. Woods, while the medical aspects of the subject were covered by Dr. Matthew Hosmer. A general discussion of the subject was then presented by Prof. Walter Weeks. Arrangements for the evening were made by the San Francisco Engineering Council.

Seattle Section

New officers for the Seattle Section were elected on January 31. These are W. R. Engstrom, president; Roy M. Harris, vice-president; and Fred H. Rhodes, Jr., secretary-treasurer.

Syracuse Section

There were 13 present at a dinner meeting of the Syracuse Section held in the Onondaga Hotel in Syracuse on January 10. Following dinner and a brief business session, the Section sponsored a lecture before the Technology Club of Syracuse, which was attended by 384. The speaker was L. B. Roberts, assistant chief engineer of the New York World's Fair, who gave an interesting illustrated talk on the layout and construction of the grounds and buildings of the fair.

Tacoma Section

Numerous business matters were discussed at the December meeting of the Tacoma Section. During this session the report of the nominating committee for 1938 officers was unanimously accepted. (These officers were listed in the January issue of Civil Engineering.) The technical program consisted of an illustrated lecture on the work at Bonneville Dam given by B. E. Torpen, senior engineer for the Corps of Engineers, U. S. Army, on the Bonneville Project. On January 15 members of the Section enjoyed the annual installation dinner and dance held at the Lakewood Community Center. A turkey dinner was followed by a pleasing program of entertainment presented by the College of Puget Sound Choral Society. After a brief business meeting, during which the new officers were installed, dancing and bridge were enjoyed.

Student Chapter Notes

Missouri School of Mines and Metallurgy

Slides on aerial photographic mapping, furnished by the Society, were enjoyed at a meeting of the Missouri School of Mines and Metallurgy, held on January 25. Capt. W. W. Hodge, who is stationed at the school, read the accompanying lecture, which he supplemented with some of his own lantern slides. After the lecture the use of a stereo-comparagraph, owned by the civil engineering department, was demonstrated. There were 30 students and 5 members of the faculty present.

New York University

Members of the New York University Student Chapter enjoyed a smoker and meeting held in the Commons Building at University Heights on January 18. Despite the cold weather and the fact that it was examination week, the attendance was large—about 100. The speaker on this occasion was John S. Dodds, professor of civil engineering at Iowa State College, who chose for his topic, "The Romance of Public Land Surveys." Professor Dodds stressed the fact that a man hired to retrace lines of the Public Land Surveys must have considerable detective ability. After his talk light refreshments were served, and there was a pleasant social hour. During the afternoon and early evening there was a reunion on campus of several of those who attended the Society for the Promotion of Engineering Education Surveying Conference at Camp Marston, Minn., and this group with members of the other Student Chapters in the metropolitan area were guests of the New York University Student Chapter.

South Dakota State College

On December 8 the Society's lantern slide lecture on the Holland Tunnel was shown before 20 members of the Student Chapter and faculty of the South Dakota State College. The slides were presented by the president of the Chapter, and Prof. H. B. Blodgett, Faculty Adviser, answered questions that were raised in the ensuing discussion.

Virginia Military Institute

The Virginia Military Institute Student Chapter held a meeting on January 11, which was addressed by L. F. Bellinger, Vice-President of the Society. Commander Bellinger presented and explained in great detail a number of slides showing the various types of construction carried on by the Civil Engineer Corps of the Navy. These include dry docks, heating and power plants, pipe lines, and other structures. The address illustrated the diverse abilities required of the civil engineer in the navy. On January 18, five members of the Chapter and the Faculty Adviser, J. A. Anderson, left to attend the Annual Meeting of the Society being held in New York. The group spent two days in the city and made several of the inspection trips. All the students kept notes, which they will read at the next Chapter meeting.

ITEMS OF INTEREST

Engineering Events in Brief

Civil Engineering for April

Among the articles scheduled for the April issue of Civil Engineering is one by Gilbert D. Fish, M. Am. Soc. C.E., consulting engineer, of New York, N.Y., on arc-welding a multi-story building. The work was done in erecting two additional wings to the main building of the New York State Hospital in Brooklyn. Bids for the steelwork had been called for on the basis of either riveted or welded construction, and the low bidder chose welding. Part of the saving in the use of welding resulted from the unusually large amount of wind bracing called for in proportion to beam weight, greatly increasing the number of rivets which would have been required had riveting been used. Another factor in the selection of welding by the low bidder was the working out in advance by Mr. Fish of the scheme of fabrication and erection and the connection details, of which many are described in the article.

New and improved designs of equipment for stream measurement, as developed by the U. S. Geological Survey, are described in an article by C. G. Paulsen, M. Am. Soc. C.E., chief of the Division of Surface Waters, Washington, D.C. To date, stream-flow records indispensable to hydraulic engineers have been collected at more than 7,000 measuring stations in the United States. In recognition of the pressing need for additional records, Congress in recent years has established a policy of matching state and municipal stream-measurement expenditures with federal funds, giving great impetus to this important activity.

The third in a series of articles on the esthetics of bridge design, by Aymar Embury II, M. Am. Soc. C.E., consulting architect, New York, N.Y., is scheduled for publication in the April number. Three simple rules for the esthetic design of steel structures are listed: Since the usual sky background reveals steel structures chiefly in silhouette, ornamentation is well-nigh valueless; the use or meaning of every structure should be made comprehensible to the layman; and relations between structural members and enclosed spaces should be agreeable. Taking for his illustrations structures recently completed or still under construction, Mr. Embury explains the application of these principles to the design of towers for two suspension bridges; to an arch ring, towers, and bents for an arch span; to a lift bridge; and to a bascule bridge.

If space permits, an article will be included on engineering in the control of erosion, by Quincy C. Ayres, M. Am. Soc. C.E., associate professor of agricultural engineering at Iowa State College, Ames, Iowa. Man-made erosion is an instance of national neglect on a grand scale now being utilized as a vehicle for the relief of unemployment. In his brief survey of conditions in this expanding field, Professor Ayres delineates the aspects of the problem which concern engineers as distinguished from foresters and agronomists. Formulas are derived from "word equations" in an illuminating manner, and data are given on the imperviousness of a wide variety of soils on varying slopes.

Wise and Otherwise

A large water tank on a farm near Professor Abercrombie's summer home was recently punctured in 100 places by vandals. The holes were of three different shapes, as follows: Circles, 1 in. in diameter; squares, 1 in. on each side; and isosceles triangles, having 1-in. base and 1-in. altitude.

When Professor Abercrombie learned of this unhappy occurrence he volunteered to design, free of charge, a single form of metal plug which would fit all three shapes of holes. The farmer insisted that he wished to pay for the service, and the Professor finally agreed to accept as payment $3.75 less than the cost to the farmer of the actual production of 100 plugs of the required design.

Having little ready money at the moment, the farmer dropped in at the local bank to cash a check which he had just received in payment for a load of eggs. In cashing this check, the teller made the mistake of paying out a number of dollars equal to the number of cents called for and a number of cents equal to the number of dollars called for. To his astonishment and delight, the farmer now found that by supplementing the proceeds of the check with 64 cents he could just meet the combined charges of the foundryman employed to make the plugs and of Professor Abercrombie (whose fee amounted to $1.72 less than the face value of the check).

What were the charges referred to and what was the shape of the plug designed by the Professor? [This problem was submitted by William Trillow, whose present address is Leeds Hospital, Leeds, Mo.]

February's problem involved a 600-ft circular track on which two horses were being tried out, starting from scratch. When running in the same direction the faster horse overtook the other 30 seconds after the start, and when running in the opposite direction passed him 10 seconds after the start. It was required to find the speed of the horses.

If y be taken as the rate of the slower horse in feet per second, then the faster horse travels $30y + 600$ ft in 30 sec when running in the same direction as the other, and $600 - 10y$ ft in 10 sec when running in the opposite direction. Since presumably both horses run at their maximum speeds in both cases, these expressions may be reduced to feet per second and equated. Then $y + 20 = 60 - y$ from which $y = 20$ ft per sec—the rate of the slower horse. The faster horse's rate is then 40 ft per sec.

Suggestions for other problems for Professor Abercrombie's column, accompanied by solutions, may be addressed to the editor. Solutions should preferably be sent in separate enclosed envelopes.

American Water Works Association Honors Two Society Members

At the annual meeting of the American Water Works Association, held in New York City on January 19, 1938, two Members of the Society were elected to honorary membership in the Association. These are Ralph W. Lawton, consulting engineer of Los Angeles, Calif., and Theodore A. Leisen, general manager of the Metropolitan Utilities District, Omaha, Nebr.

Both have been active members of the Association for many years. Mr. Lawton was one of the organizers of the California section of the Association, while Colonel Leisen has served as president of the Association and as trustee and director. Colonel Leisen is also active in the affairs of the Society and has just completed a term as Director.

Our Page of Special Interest

This month's frontispiece, or page of special interest, depicts the contrast between the old and the new in water-power development. The "old" is represented by a grist mill which was built in 1885. The "new" is illustrated by a view of Wilson Dam as seen from the power house (photo courtesy TVA).

Brief Notes from Here and There

From the Missouri School of Mines and Metallurgy comes an invitation to all interested members of the Society to attend an "Institute of Business and Industrial Relations" at Rolla, Mo., April 8 and 9, 1938. Further details may be secured from Maurice D. Orten, professor of economics at that institution.

* * * *

"How to Drive," a 100-page text just off the press, completes the American Automobile Association's series of five

pamphlets on "Sportsmanlike Driving." Other titles in the series are: *The Driver; Driver and Pedestrian Responsibilities; Sound Driving Practice;* and *Society's Responsibilities*. The pamphlets are already being used as a basic text in many high schools throughout the country, but their value extends to seasoned drivers as well. They were prepared under the supervision of Burton W. Marsh, M. Am. Soc. C.E., director of the Safety and Traffic Engineering Department of the A.A.A., and are being distributed through local A.A.A. Motor Clubs.

* * * *

A "Traffic Engineering Notebook" (mimeographed, 224 pages) has just been published by Harvard University's Bureau for Street Traffic Research. The notebook contains 37 addresses or comprehensive summaries of addresses by leading authorities in the various fields of traffic administration and control. They were originally presented at the First Traffic Engineering Training School, held at Harvard in August 1937. The book is for sale by the aforementioned bureau, 29 Holyoke Street, Cambridge, Mass., at $1.00 a copy.

* * * *

"Photoelastic Journal" made its appearance in January 1938. This new monthly publication is intended, among other things, "to make the photoelastic method of stress analysis simple in principle, practical in application, and popular in use," and "to keep the reader informed with up-to-date developments of photoelasticity and relative subjects here and abroad." The editor is Arshag G. Solakian, and the publisher's address is 55 West 42d St., New York, N.Y.

NEWS OF ENGINEERS

Personal Items About Society Members

Carl W. Smedberg has been appointed city manager of Greensboro, N.C. He was formerly director of public works for that city.

F. Harper Craddock, who has been serving as rate analyst for the Rural Electrification Administration, is now chief of the rate section of this organization.

Andrew B. Hargis recently resigned as dean of the school of engineering at the University of Mississippi to become professor of civil engineering and supervising engineer of the newly created Department of Buildings, Grounds, and Utilities at the University.

R. A. Allton, until lately sewage disposal engineer for the Columbus (Ohio) Department of Public Service, has been appointed consultant and acting superintendent in charge of the operation of the new sewage treatment works, which were recently put in operation.

W. L. Stevenson, formerly chief engineer of the Pennsylvania Department of Health, has become Pennsylvania representative for Metcalf and Eddy, engineers of Boston, Mass. Mr. Stevenson will have offices in the Telegraph Building at Harrisburg, Pa.

Francisco Gomez-Perez is at present assistant to the chief of the designing department of the Mexican National Commission of Irrigation, with headquarters in Mexico, D.F. He was formerly engineer in charge of specifications for the Commission.

P. W. Holstein, Jr., who served as senior assistant engineer in charge of the mechanical design of the new sewage-treatment works recently constructed for the city of Columbus, Ohio, has been appointed mechanical engineer in charge of the maintenance and mechanical operation of the plant.

Roland S. Wallis, formerly director of research for the Pennsylvania Economic Council, Philadelphia, has been appointed director of research and statistics for the Division of Unemployment Compensation and Employment Service, of the Pennsylvania Department of Labor and Industry. His headquarters are in Harrisburg, Pa.

B. H. Grehan, vice-president of the George J. Glover Company, Inc., of New Orleans, La., was recently elected president of the Louisiana Engineering Society for the coming year.

Hugo C. Fischer, lieutenant-commander, C.E.C., U. S. Navy, has been assigned to duty in the Bureau of Yards and Docks, Washington, D.C. He was previously public works officer at the U. S. Naval Air Station, Lakehurst, N.J.

Daniel G. O'Shea has resigned as associate engineer for the U. S. Bureau of Reclamation at Denver, Colo., to become bridge designer for the Washington State Highway Department, with headquarters at Olympia, Wash.

Nelson F. Pitts, Jr., chief engineer of the Syracuse (N.Y.) Grade Crossing Commission, has been appointed city engineer of Syracuse.

Lewis B. Combs, commander, C.E.C., U. S. Navy, recently became assistant to the chief of the Bureau of Yards and Docks, Washington, D.C.

Albion N. Van Vleck, consulting engineer of New York City, has been appointed First Deputy Commissioner of Housing and Buildings of New York City.

Edmund B. Keating, lieutenant-commander, C.E.C., U. S. Navy, has been transferred from the Portsmouth, N.H., navy yard to the Mare Island yard in California.

John A. Elliott, district engineer for the U. S. Bureau of Public Roads, has been transferred from Denver, Colo., to the Southwest District, with headquarters at Fort Worth, Tex.

K. W. Le Fever has become associated with Don A. McCrea and M. Z. Bair in an engineering practice in Little Rock, Ark., where they will specialize in water, sewer, and highway work.

Paul W. Baker has become connected with the Wellwood Engineering Company, of Lincoln, Nebr., and will be engaged on construction work on the Platte Valley, Loup, and Central Nebraska hydroelectric projects.

B. W. Matteson, until recently senior highway engineer in the regional office of the U. S. Bureau of Public Roads in San Francisco, Calif., has been transferred to Denver, Colo., where he holds a similar position.

Joseph W. Goldenberg and B. O. Cooper have established a consulting practice at 1529 North 43d Street, East St. Louis, Ill., where they will specialize in the fields of structural, industrial, and municipal engineering. Mr. Goldenberg was formerly contracting engineer for the St. Louis Structural Steel Company.

Edward M. Markham, major-general, chief of engineers, U. S. Army, has been appointed New York City Commissioner of Public Works.

J. G. Wardlaw, Jr., previously engineer-examiner for the PWA at Columbia, S.C., is now assistant to the chief engineer of the Greenwood County Hydroelectric Project, with headquarters at Greenwood, S.C.

Marshall G. Findley was recently appointed field supervisor of bridges for the city of Milwaukee, Wis. He was formerly structural engineer for the Milwaukee Water Purification Plant.

Ervin Greenbaum is now construction engineer for Rosoff Brothers, contractors for the Detroit Sewage Treatment Plant, with headquarters in Detroit, Mich.

DECEASED

William Bullard Allen (M. '04) of Birmingham, Ala., died there on January 9, 1938. Mr. Allen was born in Indianapolis, Ind., on March 12, 1863. His early career included work in railroad surveys, construction, and maintenance in this country, Mexico, and Guatemala. From 1893 until his retirement in 1933 he was in the employ of the Tennessee Coal, Iron and Railroad Company and other subsidiaries of the U. S. Steel Corporation, where he was, successively, land agent, manager of the land department, and executive agent of the Tennessee Coal, Iron and Railroad Company; manager of the Chickasaw Land Company; assistant to the president of the Ensley Land Company; and vice-president of the Birmingham Southern Railroad Company. For a time Mr. Allen was, also, chairman of the executive committee of the Port of Birmingham Company.

John Leland Becton (M. '21) consulting civil engineer of Wilmington, N.C., died in that city on January 8, 1938. Mr. Becton was born in Wayne County, North Carolina, on October 24, 1885, and was educated at North Carolina State College of Agriculture and Engineering. From 1908 to 1910 he was deputy city engineer of Wilmington, and in 1911 he established a general civil engineering practice in Wilmington that he maintained for the rest of his life. At the time of his death Mr. Becton was serving as president of the North Carolina Section.

William Alvin Blank (Jun. '33) junior engineer for the U. S. Bureau of Reclamation, Bayfield, Colo., died on December 30, 1937. Mr. Blank was born in Albuquerque, N.Mex., on October 11, 1910, and was educated at the University of New Mexico. Following his graduation in 1933, he became connected with the U. S. Indian Irrigation Service at Albuquerque, where he remained until 1936. During this period he was engaged in topographic drafting and the design of irrigation structures. In 1937 Mr. Blank became a junior engineer with the U. S. Bureau of Reclamation.

Dexter Parshall Cooper (M. '26) president of Dexter P. Cooper, Inc., an engineering firm, died in Boston, Mass., on February 2, 1938, at the age of 57. Mr. Cooper was born in Rushford, Minn., and educated in Switzerland and Germany, receiving a degree from the Royal Technical Institute of Karlsruhe in 1907. From 1911 to 1922 he was with Hugh L. Cooper and Company in varying capacities on projects in the United States and foreign countries, including the Keokuk (Iowa) Project, the Chile Project, the Salmon River development, the St. Lawrence River investigation, and the Muscle Shoals development. From 1922 until shortly before his death (when the project was discontinued) he was chief engineer of the Quoddy Power Project at Eastport, Me. Mr. Cooper was the originator of this project for utilizing the tides of the Bay of Fundy for power, and spent many years trying to interest the governments of Canada and the United States in the project.

Francis Davis Fisher (M. '88) of Pasadena, Calif., died on December 24, 1937, at the age of 90. He was born in Westboro, Mass., on February 13, 1847, and was educated at the Massachusetts Institute of Technology. In 1868 he became principal assistant engineer on the construction of the Hoosac Tunnel, and from 1875 to 1878 he was division engineer on the Sudbury River Aqueduct of the Boston Water Works. Later his career included experience as assistant engineer of construction for the Northern Pacific Railroad; as engineer on the construction of the Southern Pacific Railroad; assistant superintendent of construction and division engineer and roadmaster for the West Shore Railroad; resident engineer on construction and maintenance of the Second Avenue elevated railroad in New York City; superintendent of the Brooklyn Elevated Railroad; and supervising engineer and manager for the contractors on the construction of Croton Dam. From 1900 to 1918 Mr. Fisher was supervising engineer for the Degnon Contracting Company on works which included New York City subway construction and the Cape Cod Canal project. In the latter year he retired.

Victor Gelineau (M. '23) director and chief engineer of the New Jersey State Board of Commerce and Navigation, Newark, N.J., died suddenly of a heart attack in the Pennsylvania Station, New York City, on January 21, 1938. He was 52. Mr. Gelineau was born in Lowell, Mass., and educated at Cornell University and New York University Law School. From 1906 to 1907 he was with the Pennsylvania Railroad; from 1907 to 1910, in general surveying, municipal, and reclamation work; and from 1910 to 1911, assistant chief engineer for the Tangier Development Corporation. In 1912 he became connected with the New Jersey State Board of Commerce and Navigation as draftsman. Later he was assistant engineer and, finally, chief engineer and director. Mr. Gelineau was the author of numerous works on beach erosion, on which he was considered an authority.

The Society welcomes additional biographical material to supplement these brief notes and to be available for use in the official memoirs for "Transactions."

Guy Alexander Graham (Assoc. M. '15) president and treasurer of G. A. Graham, Inc., of Clifton, N.J., died on February 21, 1937. Mr. Graham was born in Reedsburg, Wis., on July 19, 1883, and graduated from the University of Wisconsin in 1905. From the latter year until 1910 he was with the Pennsylvania Railroad; from 1910 to 1913 he was construction engineer with the Snare and Triest Company; and from 1913 to 1917, construction engineer with McMullen and Hoff. During the war and for several years afterwards, he served as construction engineer with the U. S. Army in charge of the construction of docks, shipways, and cantonment buildings. From 1924 to 1934 Mr. Graham was vice-president and secretary of Parker and Graham, Inc., on the construction of highway and railroad bridges and tunnels, and from 1934 on he was president and treasurer of G. A. Graham, Inc.

Robert Bruce Hoadley, Jr. (M. '21) civil engineer of Binghamton, N.Y., was killed in an automobile accident near Jacksonville, Fla., on December 25, 1937. Mr. Hoadley, who was 55, was educated at Union College. Following his graduation in 1902, he joined the staff of the Western Maryland Railway Company, serving successively as topographer, resident engineer, and locating engineer. Later he was in the New York State Department of Highways, where he was assistant and, finally, first assistant engineer. In 1917 Mr. Hoadley entered private practice in Binghamton as a member of the firm of Hoadley and Giles.

Gerald Joseph Kennedy (M. '18) president and general manager of the Philippine Railway, died at his home in Iloilo, Philippine Islands, on December 25, 1937. Mr. Kennedy, who was 57, was born in Easton, Pa., and educated at Lafayette College, graduating in 1901. His early career included experience in railroad and mining work in this country, and later he spent many years in Mexico and South America locating mining and railroad properties. From 1910 to 1913 he was division engineer for the Mexican National Railways, and from 1914 to 1920 general superintendent and general manager of the Chile ore mines of the Bethlehem Steel Company. Later he was construction engineer for Ferrocarril del Pacifico de Nicaragua, and in 1931 he became connected with the Philippine Railway.

John Macdonald (M. '32) former associate professor of building construction at Union College, died at Dumont, N.J., on January 31, 1938. Mr. Macdonald was born in Glasgow, Scotland, on October 18, 1878, and graduated from New York University in 1906. He then held the position of construction superintendent for the following companies: the Bliss-Griffiths Company, 1906 to 1908; Deisler and Stephenson, 1908 to 1909; C. T. Wills, Inc., 1909 to 1916; and the Thompson-Starrett Company, 1916 to 1924. In 1924 he was named Thompson-Starrett Associate Professor of Civil Engineering at Union College, where he remained until 1933.

Orson Hill Marchant (M. '36) vice-president and secretary of Blair and Marchant, Inc., of New Haven, Conn., died suddenly on January 4, 1938. Mr. Marchant was born in Redding, Conn., on July 4, 1882, and educated at the Sheffield Scientific School of Yale University. Following his graduation in 1904, he engaged in general engineering practice in the office of Albert B. Hill, consulting engineer of New Haven, where he remained until Mr. Hill's death in 1930, specializing in design and construction From 1930 on Mr. Marchant was vice-president and secretary of the civil engineering and surveying firm, Blair and Marchant, Inc.

George Bentley Poore (M. '35) vice-president of the Calaveras Cement Company of San Francisco, Calif., died in January 1938. Mr. Poore, who was 68, was born in Montrose, Pa. From 1891 to 1893 he was chief engineer of the El Callao Mining Corporation of Venezuela, and from 1893 to 1905 mechanical engineer for the Rand Mines Ltd., in South Africa. In 1914, after a number of years in gold mining, he took charge of the work of the American Potash Chemical Corporation at Searls Lake, Calif., remaining until 1917. He then engaged in mining work until 1923, when he became associated with W. W. Mein and S. L. Rawlings, maintaining this connection until his death. During this period he designed and built the Calaveras cement plant, and for a number of years he was vice-president of the Calaveras Cement Company.

Eugene Raymond Smith (M. '01) retired civil engineer of Islip, N.Y., died at his home there on January 15, 1938, at the age of 79. Following his graduation

from Cornell University in 1877, Mr. Smith was employed as assistant engineer on the construction of the Burlington, Cedar Rapids, and Northern Railroad, and as government inspector of dredging on the improvement of navigation on the Delaware River. In 1880 he established a private engineering practice at Islip, N.Y., where he was in charge of numerous engineering projects on Long Island, including considerable work on the reclamation of salt marsh land. Mr. Smith also served as president and director of the First National Bank of Islip and as director of the Bay Shore First National Bank. Several years ago he retired from active professional and business work.

ISAAC STANLEY WALKER (M. '23) consulting engineer of Philadelphia, Pa., died on January 23, 1938, at the age of 54. Mr. Walker was a graduate of Temple University and Drexel Institute. In 1906, after holding minor positions in railroad and municipal work, he became assistant engineer in the Philadelphia Bureau of Water, where he remained until 1911. He then spent several years in the employ of the New York consulting firm of Hering and Gregory. Upon his return to Philadelphia, he served as assistant engineer in the sewage-disposal division of the Bureau of Surveys and, later, as general manager of the Chester (Pa.) Water Company. In 1930 he established his consulting practice.

WARREN WITHEE (Assoc. M. '35) hydraulic engineer for the U. S. Geological Survey, Chattanooga, Tenn., died in that city on February 3, 1938. He was 45. Mr. Withee was born in Minneapolis, Minn., and graduated from the University of Minnesota in 1915. From the latter date until 1917 he was assistant engineer for George A. Ralph, consulting engineer of St. Paul, Minn., and from 1919 to 1920 assistant engineer for S. B. Gardner, consulting engineer of Benson, Minn. In November 1920 he became connected with the U. S. Geological Survey at Chattanooga as assistant hydraulic engineer. Later he became associate hydraulic engineer and, in 1931, hydraulic engineer. During the war Mr. Withee served in the U. S. Army, 29th and 74th Engineers.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From January 10 to February 9, 1938, Inclusive

ADDITIONS TO MEMBERSHIP

AEPPLI, ERNEST (Assoc. M. '37), Structural Engr., State Dept. of Public Works (Bridge Dept.), 1836 Fifth Ave., Sacramento, Calif.

ASHWORTH, IRVING FRANCIS (Assoc. M. '38), Asst. Engr., Grade 4, Office of Chf. Engr., Board of Estimate and Apportionment (Res., 5009 Broadway), New York, N.Y.

BADGETT, STEPHEN HARRIS, JR. (Jun. '37), Care, Mrs. Bascher, 120 North Sprague Ave., Bellevue, Pa.

BENFORD, (Miss) ESTHER ROSALIND (Jun. '37), 411 Ruffner Ave., Charleston, W.Va.

BENITO, ROBERT VALENTINE (Jun. '37), Estimator, Joseph T. Ryerson and Sons, 203 Westside Ave., Jersey City, N.J.

BENNETT, HARRIS SHELL (Assoc. M. '37), Associate Engr., U. S. Engr. Office, 751 South Figueroa St. (Res., 9133 South Harvard Boulevard), Los Angeles, Calif.

BORG, JOSEPH ELMER (Jun. '37), Draftsman, Am. Bridge Co. (Res., 710 Park Rd.), Ambridge, Pa.

BRAGG, RALPH STANLEY (Assoc. M. '37), Box 255, Cave City, Ky.

BRIDGER, JOHN CASH (Assoc. M. '38), Asst. Prof., Civ. Eng., Mississippi State Coll., Box 456, State College, Miss.

BROMILOW, FRANK (Jun. '37), 832 Center Ave., Pittsburgh, Pa.

BROWN, WILLIAM YATES (Jun. '37), Junior Engr., Carter Oil Co., Box 758, Wilson, Okla.

BROWNE, HOWARD CARL (Jun. '37), 1655 Burnett St., Brooklyn, N.Y.

BRUCKNER, CHARLES JOHN (Jun. '38), 2509 South 9th St., Philadelphia, Pa.

BURD, GEORGE ADAMS (Jun. '38), With The Lummus Co., 420 Lexington Ave., New York (Res., 150–51 Eighty-sixth Ave., Jamaica), N.Y.

BURDIN, HENRY SPRAGUE, JR. (Jun. '37), 3033 South East Taylor St., Portland, Ore.

BUTTERFIELD, GLEN ROBERT, JR. (Jun. '37), 28 Gorham St., Cambridge, Mass.

BUTTON, PAUL STUART (Jun. '37), Eng. Aide, TVA, 515 Union Bldg. (Res., 1525 Laurel Ave.), Knoxville, Tenn.

CHRISTENSEN, LAWRENCE ALFRED (Jun. '38), with Bethlehem Steel Co., Leetsdale, Pa.

COPELAND, CHARLES FAULKNER (Jun. '37), Transitman, Pacific Gas & Elec. Co., Box 543, Suisun City, Calif.

COULTER, RICHARD GALLAHER (Jun. '37), 301 Hixson Ave., Syracuse, N.Y.

CRAWFORD, IVAN CHARLES, JR. (Jún. '37), 607 Louisana St., Lawrence, Kans.

CRICENTI, NICHOLAS JOSEPH (Jun. '38), 69 School St., Concord, N.H.

CULP, DENNIS KING (Jun. '37), San. Engr., Chelan County Health Dept., Wenatchee, Wash.

DAVIS, DANIEL TRIGG MCCABE (Assoc. M. '38), County Engr., Childress County, Box 536, Childress, Tex.

DAVIS, JACOF FREDRICK (Jun. '37), Cheyenne River Indian Reservation, Cheyenne Agency, S.Dak.

DOWNS, JOHN AUSTIN (Jun. '38), 257 Market St., Brighton, Mass.

DRISCOLL, DONALD (Jun. '37), 216 Coteau St., Pierre, S.Dak.

DUNHAM, FRANK CROMIE (Jun. '38), Junior Eng. Aide, TVA, 217 New Post Office (Res., 903 East Terrace), Chattanooga, Tenn.

DURRAYK, ADIL GABRIEL (Jun. '37), Enfe El-Koura, Lebanon, Syria.

ELLARSON, RICHARD LAWRENCE (Jun. '37), 2318 West Mission Ave., Spokane, Wash.

FAIIA, SALVATORE ANTHONY (Jun. '37), 86 Fairfield Ave., Waterbury, Conn.

FAVRET, HAROLD FRANCIS (Jun. '37), 4837 St. Claude Ave., New Orleans, La.

FICARRATTO, SADO CARL (Jun. '38), Junior Engr., U. S. Engrs., U. S. Engr. Office, 751 South Figueroa St., Los Angeles, Calif.

FIFE, ROWLAND WILLIAMS (Jun. '37), 246 West 1st South St., Cedar City, Utah.

FIRMIN, PHILIP (Jun. '37), Engr., Fort Lincoln Cemetery, 3201 Bladensburg Rd., N.E., Washington, D.C.

FONTENOT, OCTAVE LEON (Jun. '37), 1090 Government St., Baton Rouge, La.

FOSTER, RICHARD (Jun. '37), 811 Sixth St., Bismarck, N.Dak.

FREEMAN, WALDO DRAKE (Jun. '37), 1240 Adelaide, Tucson, Ariz.

TOTAL MEMBERSHIP AS OF FEBRUARY 9, 1938

Members	5,628
Associate Members	6,153
Corporate Members	11,781
Honorary Members	25
Juniors	3,657
Affiliates	78
Fellows	1
Total	15,542

GAITHER, CORNELIUS GORDON (Jun. '37), Asst. San. Engr., State Board of Health, 620 South 3d St., Louisville, Ky.

GEDNEY, ROBERT HUGO (Jun. '37), Research Asst., University of Minnesota, Minneapolis, Minn.

GINSBURG, ABRAM (Assoc. M. '38), Tunnel Designer, New York City Tunnel Authority, 200 Madison Ave. (Res., 750 Grand Concourse, Apartment 1-H), New York, N.Y.

GOOKIN, WILLIAM SCUDDER (Jun. '37), Box 2743, Tucson, Ariz.

GRASSO, SALVATORE (Jun. '38), Asst. in Civ. Eng., Univ. of New Hampshire, Durham, N.H.

GROSSMANN, PAUL ROYAL (Jun. '37), With Chicago Bridge & Iron Co., Care, Lago Oil & Transport Co., Aruba, N.W.I.

GUERIN, THOMAS GERARD (Assoc. M. '38), Engr., Tully & Di Napoli, Inc., 1 Bridge Plaza, Long Island City (Res., 141 Eighty-fourth St., Brooklyn), N.Y.

HALE, JOHN SYMONS (Jun. '37), Junior Hydr. Engr., U. S. Geological Survey, Krotz Springs, La.

HARRIS, PHILIP CHARLES (Jun. '37), Care, Div. of Highways, Box 1012, Eureka, Calif.

HIRSCHMAN, PAUL (Jun. '38), Draftsman, Gibbs & Hill (Res., 131 East 169th St.), New York, N.Y.

HOUSTON, CLYDE ERWIN (Jun. '37), Eng. Asst. to County Agt., Agri. Extension Service, Tucson, Ariz.

HUDSON, RICHARD CLAYTON (Jun. '38), Asst. to Supt., E. J. Cross Co., Worcester (Res., Newton St., West Boylston), Mass.

HUFF, GEORGE RUSSELL (Jun. '38), Rodman, State Highway Dept., Wenatchee, Wash.

HUNTER, CLAUDE EARL, JR. (Jun. '37), Surv. and Timekeeper, Nevada Massachussetts Co., Inc., Mina, Nev.

IRVIN, LESLIE ARTHUR (Jun. '38), Structural Engr., T. C. Kistner, 412 Architects Bldg. (Res., 2719 Raymond Ave.), Los Angeles, Calif.

IRVING, WALTER EDWARD (M. '38), Pres., Irving Subway Grating Co., Inc., 27th St., Long Island City, N.Y.

JACKSON, ROBERT AUSTIN (Jun. '37), 51 Prospect St., 4th Floor, New Haven, Conn.

JESATKO, ANTHONY JOHN (Jun. '37), 910 North Montford Ave., Baltimore, Md.

JORDAN, JAMES WELLS (Jun. '37), 399 Roosevelt Way, San Francisco, Calif.

KEENER, KENNETH BIXBY (M. '38), Designing Engr. on Dams, U. S. Bureau of Reclamation, 416 U. S. Custom House, Denver, Colo.

KINNEY, CHARLES WESLEY (Jun. '37), 501 Union Bldg., Knoxville, Tenn.

Kirkpatrick, Kenneth William (Jun. '37), Junior Eng. Aide, TVA (Res., 315 Fifteenth St.), Knoxville, Tenn.

Klotzbach, Willis O'Brien (Jun. '38), Draftsman, L.V.R.R., Bethlehem, Pa. (Res., 22 Booream Ave., Milltown, N.J.).

Leitner, Elton Raymond (Jun. '37), Road and Right-of-Way Engr., Weiser National Forest, Council, Idaho.

Linden, Arthur Richard (Jun. '37), Chainman, U. S. Bureau of Reclamation, Lind, Wash.

McCaslin, Walter Roy, II (Jun. '37), 57 North Chestnut St., Ventura, Calif.

McDougal, John Smith (Assoc. M. '37), Associate Engr., U. S. Engr. Dept. (Res., 2755 Webster St.), San Francisco, Calif.

Mahoney, Robert Matthew (Jun. '37), Sampler of Materials, U. S. Vanadium Corporation, Bishop, Calif.

Malven, Stephen Saint John (Jun. '37), Box 1088, Big Spring, Tex.

Mayfield, Isaac Newton (Jun. '37), Engr., Phillips Petroleum Co., Box 1144, Borger, Tex.

Mendez, Rafael Martin, Jr. (Jun. '38), Taft Ave. 17, Santurce, Puerto Rico.

Milford, William Frederick, Jr. (Jun. '37), 700 Oak St., Calumet, Mich.

Millard, Robert West (Jun. '37), Res. Engr., WPA, Dist. 4, Box 96, Ely, Nev.

Moncure, (Miss) Leah (Jun. '37), Bastrop, Tex.

Osborn, Caleb Ellsworth, Jr. (Assoc. M. '37), Sales Engr., Rensselaer Valve Co., Troy, N.Y. (Res., 379 Kelso Rd., Columbus, Ohio.)

Palmer, Benjamin Harvey (Assoc. M. '37), New York State Mgr., Universal Concrete Pipe Co., 642 Wellington Ave., Rochester, N.Y.

Pease, Chester Chapin, Jr. (Jun. '38), 47 South State St., Concord, N.H.

Petty, Benjamin Harrison (M. '38), Prof., Highway Eng., Purdue Univ. (Res., 707 Crestview Pl.), West Lafayette, Ind.

Rader, Emerald Glenn (Jun. '37), Senior Rodman, Constr. Dept., State Highway Comm., 727 South Broadway, Wichita, Kans.

Reynolds, Chester Thomas (Jun. '37), 931 Latimer, Ave., Ambridge, Pa.

Reynolds, Embree Ensign (Jun. '38), Junior Bridge Constr. Engr., San Francisco-Oakland Bay Bridge, 500 Sansome St., San Francisco (Res., 371 Sixty-first St., Oakland), Calif.

Richheimer, Charles Edward (Assoc. M. '38), Vice-Pres., G. A. Youngberg and Associates, Inc., 1604 Lynch Bldg., Jacksonville, Fla.

Ritter, Roy Horace (Assoc. M. '37), Care, Whitman, Requardt & Smith, West Biddle St. at Charles, Baltimore, Md.

Rowland, Henry Cottrell, Jr. (Jun. '38), Lieut., Corps of Engrs., U.S.A., Fort Du Pont, Del.

Russell, John Tucker (Jun. '37), Engr., W. & C. French, Ltd., Central London Ry., N. E. Cambridge Park Extension, Wanstead, London E, 11, England.

Ruzek, Charles V., Jr. (Jun. '37), 2d Lieut., Corps of Engrs., U.S.A., 29th Engrs., Box 5185, Portland, Ore.

Ruzika, Joseph William, Jr. (Jun. '37), 624 Fourth St., Lyndhurst, N.J.

Schiller, Bernard (Jun. '38), Deputy Health Officer, Imperial County Health Dept., El Centro, Calif.

Schlenker, Norman Edward (Jun. '37), With Bethlehem Steel Co., Keim St. (Res., Y. M. C. A.), Pottstown, Pa.

Schrader, Otto William (Jun. '37), 1385 Greenwich St., San Francisco, Calif.

Shannon, Gerard Thomas (Jun. '38), 645 Bergen Ave., Jersey City, N.J.

Sims, George Chester (Jun. '37), 656 First Ave., North Glasgow, Mont.

Smith, Roger Whalen (Assoc. M. '37), 419 West 119th St., Apartment 5 F, New York, N.Y.

Soderberg, Arthur Darwin (Jun. '37), 614 East 5th, Casper, Wyo.

Spears, Sholto Marion (Assoc. M. '38), Associate Prof., Civ. Eng., Armour Inst. of Technology, 3300 Federal St. (Res. 1720 West 105th Pl.), Chicago, Ill.

Stevens, George Bickley (Jun. '37), With TVA, 812 Georgia Ave., Chattanooga, Tenn.

Stirni, Albert Richard (Jun. '38), Geodetic Computer, U. S. Geological Survey, Room 6213, U. S. Geological Survey, Dept. of Interior, Washington, D.C.

Stoops, Chauncey Noteware (Jun. '38), 14 Fourth St., Dravosburg, Pa.

Strand, John Andrew (Jun. '37), With Mead, Ward & Hunt (Res., 438 North Francis St.), Madison, Wis.

Streithof, Charles Perry (Assoc. M. '37), Structural Engr., Dravo Corporation, Pittsburgh (Res., 1414 Ridge Ave., Coraopolis), Pa.

Stucke, Vincent Chris (Jun. '37), With J. W. Beretta Engrs., Inc., 521 Goliad St., San Antonio, Tex.

Swenson, John Perry (Jun. '37), 796 Osceola Ave., St. Paul, Minn.

Taplin, Abraham (Jun. '37), Asst. Eng. Aide, Navy Dept., Bureau of Construction and Repair (Res., 17 B Todd Pl., N.E.), Washington, D.C.

Tracey, Stephen Edward (Assoc. M. '38), Structural Engr., The Am. Steel & Wire Co., Rockefeller Bldg., Cleveland, Ohio.

Tuhus, Kenneth (Jun. '37), 2310 West Lawn Ave., Madison, Wis.

Varlan, Peter Thomas (Jun. '37), 319 Flint St., Rochester, N.Y.

Williams, Robert Knoll (Jun. '37), 1049 North Hayworth Ave., Los Angeles, Calif.

Wilsey, Edward Franklin (Assoc. M. '38), Asst. Engr., U. S. Bureau of Reclamation, Custom House, Denver, Colo.

Membership Transfers

Arlt, Arthur Williamson (Jun. '29; Assoc. M. '37), Asst. Engr., Bureau of Reclamation, U. S. Dept. of Interior, U. S. Custom House, Denver, Colo.

Bailey, Leonard Cassell (Jun. '34; Assoc. M. '37), Field Engr., City of Knoxville, City Hall Park (Res., 1714 Underwood Pl.), Knoxville, Tenn.

Bendt, Joseph Philip (Assoc. M. '25; M. '38), 298 North Manistique Ave., Detroit, Mich.

Dyer, Garvin Henry (Jun. '27; Assoc. M. '38), Asst. Supt., Springfield City Water Co. (Res., 1321 North Concord Ave.), Springfield, Mo.

Fossnight, Rex Leroy (Jun. '30; Assoc. M. '38), Chf. Structural Engr. and Estimator, Erie Concrete and Steel Supply Co., 13th and Cranberry, Erie, Pa.

Harrison, Edgar Scruggs (Jun. '31; Assoc. M. '37), Care, The Tennessee Elec. Power Co., 425 Power Bldg., Chattanooga, Tenn.

Hedberg, John (Jun. '30; Assoc. M. '38), Asst. Prof., Civ. Eng., Stanford Univ., Stanford University, Calif.

Holstein, Paul Wherritt, Jr. (Jun. '33; Assoc. M. '38), Mech. Engr., Div. of Sewage Treatment, City of Columbus, Room 105, City Hall (Res., 235 Sixteenth Ave.), Columbus, Ohio.

Hooper, Olcott Lorin (Jun. '24; Assoc. M. 34; M. '38), Hydr. Engr., Federal Power Comm., Washington, D.C.

Johnson, Walter Kenneth (Jun. '27; Assoc. M. '37), Asst. Hydr. Engr., TVA, Hydr. Laboratory, Norris, Tenn.

Lavergne Yordán, Luis (Jun. '33; Assoc. M. '37), Treas., Earl K. Burton, Inc., Box 1367, San Juan, Puerto Rico.

McKim, Robert Dan (Jun. '35; Assoc. M. '37), Designer, Black & Veatch, 4706 Broadway (Res., 315 East 48th St.), Kansas City, Mo.

Milliken, Harold Edward (Jun. '27; Assoc. M. '38), Chemist and Bacteriologist, City of Auburn (Res., 32$^1/_3$ Elm St.), Auburn, N.Y.

Ohr, Milo Frederick (Jun. '28; Assoc. M. '31; M. '38), Prin. Engr. in Chg., PWA, Region 2, 20 North Wacker Drive, Room 1701 (Res., Hotel Chicagoan, 67 West Madison St.), Chicago, Ill.

Poppe, Charles Raymond (Jun. '27; Assoc. M. '37), Associate Bridge Engr., State Div. of Highways, Box 1499, Sacramento (Res., 1256 Franklin St., Red Bluff), Calif.

Rasmussen, Howard Burnett (Jun. '27; Assoc. M. '38), Senior Field Auditor, Traffic Audit Bureau, Inc., 60 East 42d St., New York, N.Y. (Res., 4448 North Malden St., Chicago, Ill.).

Reynolds, John Franklin (Assoc. M. '20; M. '38), Cons. Engr., Box 4442, Jacksonville, Fla.

Roake, Theodore Chester (Jun. '35; Assoc. M. '37), Designing Engr., State Highway Comm. (Res., 748 North 15th St.), Salem, Ore.

Rosenberg, Samuel (Assoc. M. '27; M. '38), (Res. Engr., State Dept. of Public Works, 122 West Main St., Babylon (Res., 142 Caryl Ave., Yonkers), N.Y.

Taylor, Frederick Charles (Jun. '24; Assoc. M. '27; M. '37), Director, Highway Planning Survey, State Highway Dept., Lansing, Mich.

Topping, Charles Hinchman (Jun. '29; Assoc. M. '37), Designer, Pan-Am. Refining Corporation, Texas City (Res., 501 Eighteenth St., Galveston), Tex.

Wessman, Harold Everett (Jun. '27; Assoc. M. '28; M. '38), Prof., Structural Eng., Coll. of Eng., New York Univ., University Heights, New York, N.Y.

White, Harry Edwin (Jun. '32; Assoc. M. '38), Junior Engr., U. S. Bureau of Reclamation, Dept. of the Interior, Denver (Res., Penrose), Colo.

Willier, Thomas Edward (Jun. '27; Assoc. M. '37), 430 Poplar St., Springfield, Mo.

Wineland, Jeff Andrew (Jun. '32; Assoc. M. '38), Associate Engr., Bureau of Reclamation, Custom House, Denver, Colo.

Reinstatements

Carter, Harry Vern, Assoc. M., reinstated Jan. 26, 1938.

Erlandzon, Anders Hugo, Assoc. M., reinstated Feb. 8, 1938.

Gillette, Paul Clifford, Assoc. M., reinstated Jan. 13, 1938.

Johnson, Theodore Sedgwick, Assoc. M., reinstated Jan. 25, 1938.

Mabbott, Lyle Willard, Jun., reinstated Jan. 20, 1938.

Oblan, Jacob Caleb, Assoc. M., reinstated Jan. 21, 1938.

Riker, Carroll Livingston, Jr., Assoc. M., reinstated Jan. 20, 1938.

Riley, John Philip, Assoc. M., reinstated Jan. 28, 1938.

Schauffler, Henry Albert, Assoc. M., reinstated Jan. 12, 1938.

Shirey, Lacy Lambert, Assoc. M., reinstated Jan. 26, 1938.

Simmons, John Wilhelm, Jr., M., reinstated Sept. 13, 1937.

Suozzo, Leonard Salvatore, Assoc. M., reinstated Jan. 18, 1938.

Wallace, Robert Wilmot, M., reinstated Jan. 25, 1938.

Williamson, Lee Hoomes, M., reinstated Jan. 20, 1938.

Resignations

Abel, Norman August, Assoc. M., resigned Jan. 7, 1938.

Alperin, Max, Assoc. M., resigned Jan. 17, 1938.

Aull, Luther Bachman, Jr., Assoc. M., resigned Jan. 13, 1938.

Bergmeister, Charles Nicholas, Jun., resigned Jan. 17, 1938.

Berkey, Esto Ray, Jun., resigned Jan. 14, 1938.

Cotten, Shepard Marrast, M., resigned Jan. 12, 1938.

de Tarnowsky, Jacques, M., resigned Jan. 10, 1938.

Fuellhart, Donald Egbert, Assoc. M., resigned Jan. 26, 1938.

Hannevold, Peder Louis, Assoc. M., resigned Feb. 8, 1938.

Kanters, Englebert Christian, Assoc. M., resigned Jan. 10, 1938.

Keagy, Arthur David, Assoc. M., resigned Feb. 3, 1938.

Kelsey, James Robert, M., resigned Jan. 20, 1938.

McArthur, Claire Luvoice, Jr., Jun., resigned Jan. 20, 1938.

Munn, James, M., resigned Jan. 10, 1938.

Pickett, George Henry, Jun., resigned Jan. 26, 1938.

Roberts, Cyrus Marion, Assoc. M., resigned Jan. 17, 1938.

Robinson, Meade Morrison, Jun., resigned Feb. 3, 1938.

Thomson, David Dittmar, M., resigned Feb. 8, 1938.

Tourek, James Charles, Jun., resigned Jan. 26, 1938.

Woods, Edwin Marechal, Assoc. M., resigned Jan. 18, 1938.

Young, David Milson, Jun., resigned Feb. 2, 1938.

Zwissler, Gordon Arthur, Jun., resigned Jan. 20, 1938.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment of Members to Board of Direction

March 1, 1938 NUMBER 3

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years*	5 years of important work
Associate Member	Qualified to direct work	27 years	8 years*	1 year
Junior	Qualified for sub-professional work	20 years †	4 years*	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years*	5 years of important work
Fellow	Contributor to the permanent funds of the Society			

* Graduation from an engineering school of recognized reputation is equivalent to 4 years of active practice.

† Membership ceases at age of 33 unless transferred to higher grade.

The fact that applicants refer to certain members does not necessarily mean that such members endorse.

ADMISSIONS

ALEXANDER, JOE BARKLEY, Tyler, Tex. (Age 32.) Asst. Div. Civ. Engr., Humble Oil & Refining Co., Houston, Tex. Refers to G. H. Lacy, W. H. Mead, W. P. Moore, S. W. Oberg, L. B. Ryon, Jr.

ANDRES, ROBERT WILLIAM, St. Paul, Minn. (Age 25.) Refers to F. Bass, A. S. Cutler, L. G. Straub.

ATTAWAY, JOSEPH GRADY, Statesboro, Ga. (Age 35.) J. G. Attaway Constr. Co., general contracting, highway bridges, etc. Refers to W. C. Caye, Jr., M. E. Cox, W. A. Hansell, F. H. McDonald, C. A. Marmelstein, S. B. Slack.

AYERS, JAMES ROBERT, JR., Arlington, Va. (Age 33.) Asst. Structural Engr., Bureau of Yards and Docks, Navy Dept., Washington, D.C. Refers to A. Amirikian, F. Kerekes, J. G. McKenzie, B. Moreell, L. B. Ryon, Jr., E. C. Seibert, W. H. Smith, D. C. Webb.

BARCLAY, LELAND, Austin, Tex. (Age 33.) Asst. Prof. of Civ. Eng., Univ. of Texas. Refers to E. C. H. Bantel, R. F. Dawson, J. P. Exum, J. A. Focht, R. S. Guinn, T. U. Taylor, G. G. Wickline.

BERMEO-CEVALLOS, CARLOS HUGO, Quito, Ecuador. (Age 25.) Chf. Engr., Ecuadorian Air Force. Refers to W. Allan, R. E. Goodwin, T. H. Prentice, J. J. Theobald.

BICKEL, JOHN OTTO, New York City. (Age 41.) Asst. Engr. with Waddell & Hardesty and Parsons, Klapp, Brinckerhoff & Douglas. Refers to T. E. Brown, F. De Schauensee, W. J. Douglas, H. A. Foster, S. Hardesty, E. L. Macdonald, S. A Thoresen.

BLACK, JOSEPH KENNETH, Chattanooga, Tenn. (Age 38.) Asst. Constr. Engr., Chickamauga Dam, TVA. Refers to C. P. Dunn, J. P. Growdon, C. B. Hawley, J. B. Hays, J. W. Rickey, L. G. Warren, R. White.

BLUE, JACK WASHBURN, Seattle, Wash. (Age 25.) Refers to G. E. Hawthorn, A. L. Miller, F. H. Rhodes, Jr.

BRENSLEY, ALBERT ABRAHAM, Kankakee, Ill. (Age 40.) Supt. and Engr. in Charge, Dept. of Sewerage & Sewage Treatment. Refers to H. E. Babbitt, C. E. De Leuw, M. L. Enger, J. M. Fourmy, W. D. Gerber, S. A. Greeley, P. Hansen, C. S. Nichols, E. B. Parsons, I. C. Peterson, H. E. Schlenz, W. E. Stanley, A. N. Talbot, F. R. Theroux, W. H. Wisely.

BULL, CHARLES BEEKMAN, New York City. (Age 41.) Field Engr., Asst. Chf. of Planning, etc., WPA, sewers, Manhattan. Refers to W. W. Brush, S. T. Goldsmith, H. M. Hale, C. M. Knez, E. Pittarelli.

CAREW, JOHN FRANCIS, JR., New York City. (Age 33.) Res. Engr. Inspector, FEA of PW, Long Island City, N.Y. Refers to B. J. Ahearn, D. G. Baillie, Jr., M. T. Bolmer, J. R. Breuchaud, J. A. Sargent, J. C. Scott, S. M. Swaab.

CARLSON, HARRY, St. Paul, Minn. (Age 30.) Asst. Engr. (in charge of Concrete and Soils Laboratory), U. S. Engr. Office. Refers to F. Bass, A. S. Cutler, H. M. Hill, L. G. Straub.

CLARK, JAMES BENTON, Evansville, Ind. (Age 24.) With Louisville & Nashville R.R. Co. Refers to N. W. Dougherty, R. T. Brown.

CLARY, JOHN NORWOOD, Richmond, Va. (Age 32.) Bridge Designer, Virginia Dept. of Highways. Refers to A. H. Bell, J. W. Elliott, W. R. Glidden, R. Messer, C. Miller, H. G. Shirley.

CORDOVA, JAVIER, Wilson Dam, Ala. (Age 25.) Jun. Geologic Aide, TVA. Refers to C. P. Berkey, H. M. Clute, P. J. Freeman, H. Howie, M. C. Thomas, C. P. Wright.

COURTNEY, NEVILLE COLE, Gloucester City, N.J. (Age 45.) Structural and Hydr. Engr. with Joel D. Justin, Philadelphia, Pa. Refers to C. Ashley, J. E. Boatrite, L. L. Calvert, W. H. Gravell, P. L. Heslop, R. C. Johnson, J. D. Justin.

COURTRIGHT, FREDERICK VAIL, Centerburg, Ohio. (Age 23.) Refers to J. M. Montz, C. T. Morris, J. C. Prior.

CRANGLE, DALE EVERETT, Washington, D.C. (Age 36.) Asst. Topographic Engr., U. S. Geological Survey. Refers to M. W. Furr, M. J. Harden, J. M. Holmes, D. Kennedy, R. R. Monbeck, C. L. Sadler, W. A. Tingey.

DICKMAN, W. BERNARD, San Francisco, Calif. (Age 28.) Civ. Eng. Inspector, Public Utilities Comm., City and County of San Francisco, Calif., and Res. Engr. in responsible charge of construction of Air Terminal Bldg. (reinforced concrete) on Yerba Buena Shoals. Refers to T. G. Engstrum, J. J. Gould, W. M. Johnson, H. G. Sharp, J. H. Turner.

DRAKE, HARRY LAURIN, Woodward, Okla. (Age 24.) Eng. Aide, U. S. Army Engrs., Woodward Sub-Office. Refers to T. S. Burns, H. B. Compton, T. R. Lawson, H. O. Sharp, E. R. Wiseman.

EUSTANCE, HARRY WINFIELD, Rochester, N.Y. (Age 35.) Civ. Engr., Eng. & Maintenance Dept., Eastman Kodak Co. Refers to C. H. Brown, C. Crandall, W. W. DeBerard, S. C. Hollister, G. D. Holmes, W. H. Roberts, F. E. Schmitt.

FALEY, THOMAS EDWARD, Harrisburg, Pa. (Age 22.) Asst., Eng. Corps, Pennsylvania R.R. Refers to C. G. Melville, E. D. Walker.

FRASER, ROBERT HAMILTON, New York City. (Age 24.) Refers to J. J. Costa, F. C. Zehetner.

GARRIS, CHARLES AUGUSTUS, Baltimore, Md. (Age 32.) In private practice. Refers to P. G. Crout, E. Mowlds, J. M. Russell, V. P. Saxe, C. W. Snyder.

GEORGE, HENRY HORTENSIUS, 3d, Norfolk, Va. (Age 49.) Asst. Engr. in Charge of Services, Dept. of Public Works, Norfolk, Va. Refers to J. A. Anderson, G. M. Bowers, C. E. Dexter, E. M. Hastings, R. S. Hummel, R. S. Royer, A. J. Saville.

GIRARD, PETER FRED, JR., Chicago, Ill. (Age 40.) Acting Engr. of Sewer Design, San. Dist. of Chicago. Refers to L. B. Barker, L. W. Hall, L. Pearse, H. P. Ramey, H. S. Ripley, W. H. Trinkaus, L. C. Whittemore.

GLYNN, FREDERIC STANLEY, JR., Medford, Mass. (Age 27.) Testing Engr. with Stone & Webster Eng. Corporation, Boston, Mass. Refers to M. N. Clair, E. A. Dockstader, R. W. Horne, J. J. Hurley, J. D. Mitsch, W. C. Voss.

GOETZ, EDGAR AUGUST, St. Paul, Minn. (Age 57.) Chf. Structural Engr. and Advertising Mgr., St. Paul Foundry Co. Refers to B. Blum, H. K. Dougan, A. J. Duvall, M. S. Grytbak, G. V. Guerin, Jr., M. W. Hewett, W. E. King, H. S. Loeffler, A. A. McCree, E. S. Nelson, W. H. Sleeger.

GRIFFITH, GEORGE MALCOLM, Des Moines, Iowa. (Age 44.) Dist. Engr., Iowa, Nebraska and Missouri Culvert & Pipe Companies. Refers to C. H. Currie, A. F. Fischer, H. R. Green, P. F. Hopkins, R. B. Kittredge, M. C. Noble, F. R. White.

HAYES, STEPHEN ALEXANDER, San Gabriel, Calif. (Age 41.) Supervisor of Surveys, Dept. of Water & Power, Los Angeles, Calif. Refers to E. A. Bayley, H. P. Bliss, W. W. Hurlbut, D. A. Lane, J. E. Phillips, R. R. Proctor, H. A. Van Norman.

HEDGES, JAMES ALLEN, Salt Lake City, Utah. (Age 31.) With Div. of Eng., U. S. Forest Service, Region No. 2, All Service Transportation Planning. Refers to T. C. Adams, R. B. Ketchum, V. L. Minear, C. Rohwer, F. C. Scobey, L. M. Winsor.

HUME, RITCHEY, Chattanooga, Tenn. (Age 34.) Representative of Gen. Office Engr., TVA. Refers to J. H. Dorroh, A. S. Fry, T. A. Jordan, O. Laurgaard, A. F. Reichmann, G. E. Tomlinson, L. G. Warren, H. A. Wiersema, W. G. Zimmermann.

HUNTER, HAYDN RECORDS, Topeka, Kans. (Age 45.) Member of firm, A. W. Hefling, Cons. Engrs., Hutchinson, Kans. Refers to B. Boyle, H. E. Frech, A. W. Hefling, R. E. Lawrence, F. B. McKinnell, R. E. Reed.

JAHNCKE, PAUL FREDERIC, New Orleans, La. (Age 58.) Pres., Jahncke Service, Inc., also Vice-Pres., Shipside Storage Co. Refers to L. W. Baldwin, F. N. Billingsley, E. S. Bres, F. C. Carey, J. F. Coleman, E. H. Connor, D. Derickson, E. L. Jahncke, F. M. Masters, H. A. Sawyer, F. L. Thompson, F. B. Wilby.

JOHNSON, GEORGE PETER, Ridgewood, N.Y. (Age 28.) 2d Lieut., Corps of Engr.-Reserve, Structural Draftsman, New York City Tunnel

Authority, New York City. Refers to A. M. Anderson, R. T. Gordon, M. J. Popper, G. S. Reeves, E. J. Squire.

KIRCHHOFF, ARTHUR AUGUST GERHART, Morgantown, W.Va. (Age 35.) With U. S. Army and State of West Virginia, being Asst. Prof., West Virginia Univ., teaching military engineering. Refers to G. P. Boomsliter, F. C. Carey, W. E. R. Covell, R. P. Davis, F. J. Seery.

LEEUW, HENRY ALEXANDER, New York City. (Age 55.) Constr. Engr., Allen N. Spooner & Son, Inc. Refers to F. R. W. Cleverdon, J. H. Fitzgerald, J. D. Mead, A. V. Sielke, R. N. Spooner.

LEONARD, CHARLES ANTHONY, Rock Island, Ill. (Age 29.) Asst. Engr., U. S. Engr. Office. Refers to J. B. Alexander, J. H. Childs, J. E. Jewett, F. T. Mavis, H. P. Warren.

LOGAN, JOHN ALEXANDER, Columbia, Mo. (Age 29.) Instructor, Dept. of Civ. Eng., Univ. of Missouri. Refers to G. M. Fair, A. H. Fuller, W. E. Galligan, W. S. Johnson, H. Rubey.

MITCHELL, STEWART, Sacramento. Calif. (Age 52.) Asst. Bridge Engr., Bridge Dept., Div. of Highways, California. Refers to C. E. Andrew, F. J. Grumm, C. B. McCullough, F. W. Panhorst, G. S. Paxson, C. S. Pope, T. E. Stanton, Jr., G. D. Whittle.

MORRISON, JOHN ALLAN, Fort Riley, Kans. (Age 24.) 2d Lieut., Corps of Engrs., U. S. Army. Refers to E. F. Coddington, G. E. Large, J. M. Montz, C. T. Morris, J. C. Prior, C. E. Sherman, R. C. Sloane.

MORTON, JOHN ORDWAY, Concord, N.H. (Age 35.) Constr. Engr., New Hampshire Highway Dept. Refers to E. W. Bowler, A. Casagrande, J. W. Childs, F. E. Everett, L. F. Johnson, L. C. Marshall.

NEUWAHL, MALCOLM, Pittsburgh, Pa. (Age 23.) Refers to A. P. Richmond, Jr., R. Ridgway, S. M. Siesel, E. S. Taub, E. D. Walker, L. W. Whitehead.

OLDHAM, GEORGE ELROD, Baton Rouge, La. (Age 37.) City Engr. Refers to R. L. Barnes, E. L. Erickson, N. E. Lant, J. S. Waldrep, J. R. Wendt, Sr.

OLMSTEAD, CARLOS BOYES, Hastings, Nebr. (Age 24.) Computer, Right-of-Way Dept., Central Nebraska Public Power & Irrigation Dist. Refers to M. I. Evinger, R. O. Green, H. J. Kesner, C. E. Mickey, J. Sorkin.

PADDOCK, FRED WILLIAM, Las Cruces, N.Mex. (Age 27.) Rodman, International Boundary Comm., U. S. Sec. Refers to J. H. Dorroh, S. H. Sims.

PAUW, ADRIAN, Seattle, Wash. (Age 22.) Refers to F. B. Farquharson, R. G. Hennes, A. L. Miller, C. C. More, F. H. Rhodes, Jr., R. G. Tyler.

RABBITT, AUSTIN JEROME, Rochester, N.Y. (Age 44.) Refers to H. L. Howe, I. E. Matthews, W. H. Roberts, J. F. Skinner, L. B. Smith, E. H. Walker, E. B. Woodin.

RICE, EDWARD BURNS, Montgomery, Ala. (Age 30.) Acting Dist. Office Engr., Surface Water Div., Water Resources Branch, U. S. Geological Survey. Refers to D. H. Barber, B. L. Bigwood, C. E. Ellsworth, H. Johnson, J. T. L. McNew, C. G. Paulsen.

ROLER, HOWARD DIETRICH, Woodside, N.Y. (Age 24.) Refers to L. V. Carpenter, C. T. Schwarze, E. J. Squire, D. S. Trowbridge.

SCHUSTER, KARL RUDOLPH, New York City. (Age 59.) Cons. Engr. Refers to T. Barbato, T. S. Clark, F. E. Emery, E. H. Harder, A. Hardoncourt, O. E. Hovey, W. Mueser.

SHAFER, IRVEN CLARENCE, Topeka, Kans. (Age 39.) Bridge Inspector (special assignment), Kansas Highway Comm. Refers to W. K. Dinklage, C. I. Felps, R. D. Finney, R. J. Justice, R. H. Pennartz.

SMITH, LEON ALBERT, Madison, Wis. (Age 47.) Supt., Water Dept. Refers to F. M. Dawson, J. L. Ferebee, D. W. Mead, J. P. Schwada, C. V. Seastone, F. E. Turneaure.

SPENCE, THOMAS REESE, Dallas, Tex. (Age 42.) Erection Supt., Fordyce Gravel Co. Refers to E. P. Arneson, R. W. Briggs, G. Gilchrist, T. C. Mitchell, Jr., R. J. Potts, G. G. Wickline.

STANLEY, LE ROY SYLVESTER, Buffalo, N.Y. (Age 32.) Contr.'s Engr., McLain Constr. Corporation. Refers to A. J. Ackerman, M. W. Lautz, J. R. Rumsey, H. O. Schermerhorn, N. Stone.

STEELE, HARRY WILLIAMS, West Springfield, Mass. (Age 57.) Town Engr., West Springfield, Mass.; also in private practice (Steele Brothers). Refers to J. A. Dunn, J. A. Johnston, E. E. Lochridge, G. A. Sampson, C. M. Slocum, C. U. Stepath, J. L. Tighe.

STRUMER, SAMUEL, White Plains, N.Y. (Age 43.) Engr., Dept. of Bldgs., Borough of Manhattan, City of New York. Refers to L. A. Ball, H. Cash, J. Feld, D. Gutman, C. Mayer, E. E. Seelye.

THAL, DONALD EDWARD, San Francisco, Calif. (Age 28.) Design Engr., Link-Belt Co. Refers to A. W. Consoer, C. Jenkins, C. H. Westcott.

VAUBEL, ESTILLE ARTHUR, Houston, Tex. (Age 34.) Engr., Layne Texas Co. Refers to C. S. Clark, R. J. Cummins, J. B. Dannenbaum, A. H. Fuller, F. Kerekes, A. Marston, A. Tamm.

VELZY, CHARLES R, Snyder, N.Y. (Age 46.) Designing and Constr. Engr. with Greeley & Hansen, Cons. Hydr. and San. Engrs., Chicago, Ill. Refers to J. K. Giesey, S. A. Greeley, P. Hansen, E. P. Lupfer, J. R. Rumsey, F. C. Sellnow.

WEBER, JOHN LEROY, Washington, D.C. (Age 51.) Hydr. Engr., Div. of Research, Soil Conservation Service. Refers to J. N. Brooks, H. T. Critchlow, W. L. Drager, R. S. Goodridge, H. F. Harris, O. W. Hartwell, C. S. Jarvis, D. B. Krimgold, O. Lauterhahn, H. R. Leach, C. E. Ramser, E. W. Schoder.

WOODALL, LEWIS FREDERICKS, Atlanta, Ga. (Age 34.) Eng.-Draftsman, Georgia State Highway Dept. Refers to M. E. Cox, B. L. Crenshaw, C. A. Marmelstein, R. W. Torras, C. W. Wright.

WYSONG, JOHN BOND, Washington, D.C. (Age 35.) Associate Engr., Resettlement Administration. Refers to H. F. Anthony, H B. Bursley, P. M. Larsen, J. T. Thompson, H. E. Whitney.

YOUNG, SAMUEL RICHARD, Fairfield, Ala. (Age 21.) With U. S. Steel Corporation as Field Engr., Tennessee Coal, Iron & R.R. Co. Refers to R. P. Black, C. D. Gibson, J. A. Higgs, Jr., F. C. Snow, S. R. Young.

ZALOUDEK, JAMES, Chicago, Ill. (Age 34.) Draftsman (acting as Structural Designer and Plant Layout Engr.), Burrell Eng. & Constr. Co. Refers to E. E. Bauer, W. E. Cowan, W. C. Huntington, T. C. Shedd, C. C. Wiley.

FOR TRANSFER

FROM THE GRADE OF ASSOCIATE MEMBER

CARDWELL, JOHN WESLEY, Assoc. M., Jackson Heights, N.Y. (Elected May 13, 1935.) (Age 46.) Refers to F. S. Childs, W. F. Dennis, W. H. Gravell, W. Green, J. B. Martin, G. E. Pidcock.

CLEARY, JOHN BELFORD, Assoc. M., Denver, Colo. (Elected Junior Sept. 9, 1919; Assoc. M. June 6, 1921.) (Age 46.) Regional Engr., Land Utilization Div., Farm Security Administration, U. S. Dept. of Agriculture. Refers to E. W. Burritt, J. A. Elliott, R. D. Goodrich, C. M. Lightburn, R. I. Meeker, H. T. Person.

DOWNING, CLAIRE ANSEL, Assoc. M., St. Louis, Mo. (Elected June 15, 1936.) (Age 38.) Engr. in Chg., Municipal Testing Laboratory. Refers to W. C. E. Becker, R. B. Brooks, M. H. Doyne, R. P. Garrett, M. F. Marks, W. E. Rolfe, J. C. Travilla.

HOLBROOK, EDWIN CHARLES, Assoc. M., Manila, Philippine Islands. (Elected Sept. 12, 1921.) (Age 48.) Correspondent, in charge of sales, U. S. Steel Products Co. Refers to I. T. Heller, H. L. Noyes, I. Oesterblom, C. M. Spofford, E. C. Stocker.

HOWARD, JOHN WILBUR, Assoc. M., Moscow, Idaho. (Elected April 15, 1929.) (Age 43.) Asst. Prof. of Civ. Eng., Univ. of Idaho. Refers to J. B. Cleary, E. H. Collins. I. C. Crawford, T. H. Judd, C. M. Lightburn, M. K. Snyder, A. J. Turner.

JORGENSEN, PAUL JOHAN, Assoc. M., St. Petersburg, Fla. (Elected Dec. 16, 1929.) (Age 36.) Structural Engr. and Asst. City Engr. Refers to C. E. Burleson, F. L. Gorman, H. Kercher, J. W. Leroux, R. G. Ridgely, W. E. Robinson, G. A. Youngberg.

LIPP, MORRIS NATHAN, Assoc. M., Miami Beach, Fla. (Elected March 5, 1928.) (Age 39.) City Engr. Refers to E. Friedman, M. B. Garris, V. Gelineau, C. S. Nichols, M. Pirnie, R. W. Reed, C. A. Renshaw.

O'BRIEN, MORROUGH PARKER, Assoc. M., Berkeley, Calif. (Elected Junior July 12, 1926; Assoc. M. Dec. 16, 1929.) (Age 35.) Prof., and Chairman, Dept. of Mech. Eng., Univ. of California. Refers to B. A. Etcheverry, W. K. Hatt, J. Hinds, C. G. Hyde, E. H. Sargent, C. M. Spofford, J. C. Stevens.

OTT, LEONARD EUGENE, Assoc. M., Seattle, Wash. (Elected March 5, 1928.) (Age 44.) Engr., City Light Dept. Refers to N. A. Carle, A. Donaldson, S. H. Hedges, H. S. Loeffler, B. E. Torpen.

PERSON, HJALMAR THORVAL, Assoc. M., Laramie, Wyo. (Elected Junior Oct. 1, 1926; Assoc. M. April 27, 1931.) (Age 35.) Prof. of Civ. Eng., Univ. of Wyoming; Cons. Engr.; Pres. and Vice-Pres., Wyoming Board of Examining Engrs. Refers to E. W. Burritt, H. S. Carter, R. A. Caughey, J. B. Cleary, J. A. Elliott, A. H. Fuller, R. D. Goodrich, E. K. Nelson.

PHILLIPS, CUSHING, Assoc. M., Guantanamo Bay, Cuba. (Elected Dec. 15, 1924.) (Age 43.) Lieut. Commander, C.E.C.; Public Works Officer, U. S. Naval Station. Refers to W. M. Angas, R. E. Bakenhus, A. G. Bisset, L. B. Combs, A. L. Parsons, R. L. Pettigrew, D. C. Webb.

RADER, LLOYD FORREST, Assoc. M., Brooklyn, N.Y. (Elected Junior Dec. 15, 1924; Assoc. M. Aug. 26, 1929.) (Age 35.) Lieut., C.E.C., U. S. Naval Reserve; Associate Prof. of Civ. Eng., Polytechnic Inst. of Brooklyn. Refers to H. R. Codwise, W. J. Emmons, H. P. Hammond, W. S. LaLonde, Jr., C. E. Mickey, R. L. Morrison, H. S. Rogers, E. J. Squire.

SANDBERG, CLIFFORD HELMER, Assoc. M., Chicago, Ill. (Elected June 27, 1932.) (Age 36.) Asst. Engr., Bridge Dept., Atchison, Topeka & Santa Fe R.R. Refers to A. S. Cutler, G. W. Harris, H. Penn, R. A. Van Ness, C. E. Webb.

SIMPSON, CHARLES RANDOLPH, Assoc. M., New York City. (Elected Junior Feb. 2, 1909; Assoc. M., Sept. 3, 1912.) (Age 54.) Member of firm, Simpson & Brown, Contr. Engrs. Refers to C. M. Africa, E. Y. Allen, W. A. Courtenay, Jr., F. W. Doolittle, J. Downer, J. K. Giesey, N. R. McLure, F. N. Spencer.

FROM THE GRADE OF JUNIOR

ALEWINE, JAMES K., Jun., Ft. Worth, Tex. (Elected Sept. 9, 1935.) (Age 33.) With Hawley, Freese & Nichols, Cons. Engrs. Refers to J. D. Fowler, S. W. Freese, A. H. Hunter, R. D. Landon, F. R. Naylor, M. C. Nichols.

BALDWIN, ORVAL JAMES, Jun., Iowa City, Iowa. (Elected Oct. 14, 1929.) (Age 30.) State Planning Engr. in charge of Planning Div., Iowa State Planning Board; also Asst. Prof., Dept. of Civ. Eng., Univ. of Iowa. Refers to E. Bartow, F. H. Fowler, A. H. Holt, W. W. Horner, R. H. Matson, F. T. Mavis, C. E. Sherman.

BOTTOMS, ERIC EDMUND, Jun., Chicago, Ill. (Elected Nov. 10, 1930.) (Age 32.) Assoc. Engr. (Civ.), U. S. Engr. Office. Refers to C. L. Allen, C. R. Andrew, E. H. Coe, D. H. Connolly, S. N. Karrick, L. P. Murphy, L. J. Sverdrup, J. W. Woermann, H. C. Woods.

BUCK, ROBINSON DUDLEY, Jun., Hartford, Conn. (Elected Oct. 26, 1931.) (Age 28.) Associate with Henry Wolcott Buck, Cons. Engr. Refers to C. J. Bennett, H. L. Blakeslee, R. J. Ross, W. J. Scott, A. L. Shaw, R. H. Suttie.

BUELL, ELMER ELLIOTT, Jun., Omaha, Nebr. (Elected June 9, 1930.) (Age 32.) Asst. Highway Engr., U. S. Bureau of Public Roads. Refers to A. L. Anderson, E. L. Brown, F. C. Magruder, H. F. Schryver, C. E. Sherman, C. Shoemaker, F. J. Trumpour.

CROPPER, GEORGE BERTRAND, Jun., Cecilton, Md. (Elected Oct. 30, 1933.) (Age 29.) Jun. Engr., U. S. Engr. Dept., Baltimore, Md. Refers to H. C. Bird, E. J. Dent, J. S. Doyle, W. H. Hall, A. E. Steere.

ERTHAL, KARL EMIL, Jun., Baltimore, Md. (Elected Oct. 26, 1931.) (Age 34.) Asst. Engr., Whitman, Requardt & Smith, Cons. Engrs. Refers to G. L. Hall, N. D. Kenney, G. J. Requardt, M. E. Scheidt, J. T. Thompson, E. B. Whitman, A. Wolman.

FLAGG, JAMES DONALD, Jun., Knoxville, Tenn. (Elected Oct. 14, 1929.) (Age 32.) Asst. Engr., TVA. Refers to D. P. Cooper, M. Hendee, A. A. Meyer, C. E. Pearce, L. G. Puls, H. P. Rust, M. T. Thompson.

FRENCH, RICHARD CHARLES, Jun., Brooklyn, N.Y. (Elected Oct. 10, 1927.) (Age 31.) Transitman, Grade 4, Div. of Sewage Disposal and Intercepting Sewers, Dept. of Public Works, New York City. Refers to W. Donaldson, E. J. Fort, A. R. Glock, R. H. Gould, N. I. Kass.

GIBBINGS, PERCY NICHOLAS, JR., Jun., Norfolk, Va. (Elected Nov. 10, 1930.) (Age 33.) Engr., Tidewater Constr. Corporation. Refers to E. S. Borgquist, W. T. Howe, F. C. Kelton, J. C. Park, J. W. Powers, A. M. Traugott.

GOODWIN, ALBERT BURKE, Jun., Santa Fe, N. Mex. (Elected March 5, 1928.) (Age 32.) Asst. Engr., U. S. Geological Survey. Refers to E. L. Barrows, G. H. Canfield, C. E. Ellsworth, B. Johnson, W. A. Laflin.

HINCKLEY, HORACE PARKER, Jun., Redlands, Calif. (Elected April 27, 1931.) (Age 29.) Engr., San Bernardino Valley Water Conservation Dist. Refers to W. R. Chawner, B. Dibble, G. S. Hinckley, W. P. Rowe, A. L. Sonderegger, K. Q. Volk, A. A. Webb.

HOFFMAN, GERALD HENRY, Jun., St. Louis, Mo. (Elected Nov. 23, 1931.) (Age 32.) Engr., Constr. Dept., Johns Manville Corporation. Refers to G. G. Black, E. C. Constance, E. M. Kniestedt, E. O. Sweetser, D. L. White.

MORIN, JOHN ABNER, Jun., Berkeley, Calif. (Elected Dec. 14, 1936.) (Age 32.) Asst.

Engr., Joint Highway Dist. No. 13, Oakland, Calif. Refers to N. D. Baker, W. B. Boggs, M. C. Collins, P. K. Davis, T. E. Ferneau, A. S. Gelston, J. S. Longwell.

ORIVE ALBA, ADOLFO, Jun., Tijuana, L.C., Mexico. (Elected Feb. 19, 1934.) (Age 32) Gen. Mgr., Rodriguez Dam Project (Tijuana Irrigation Dist.), Mexican Irrigation Comm. Refers to E. H. Burroughs, Jr., C. H. Howell, L. A. Robb, S. W. Stewart, C. P. Williams.

ORSELLI, ALFRED JOSEPH, Jun., Berkeley, Calif. (Elected Oct. 10, 1927.) (Age 32.) Constr. Engr., Bechtel & McCone Corporation. Refers to S. D. Bechtel, R. E. Davis, B. A. Etcheverry, E. C. Panton, O. W. Peterson, P. R. Quick.

OWENS, TERRENCE JOSEPH, Jun., Pueblo, Colo. (Elected Oct. 14, 1929.) (Age 32.) Dist. Director, WPA. Refers to C. L. Eckel, V. K. Jones, C. E. Learned, E. L. Mosley, C. D. Vail, A. K. Vickery.

PAUSTIAN, RAYMOND GEORGE, Jun., Ames, Iowa. (Elected Oct. 14, 1929.) (Age 32.) Asst. Prof. of Civ. Eng., Iowa State College. Refers to T. R. Agg, R. A. Caughey, R. W. Crum, J. S. Dodds, A. H. Fuller, W. E. Galligan, H. J. Gilkey, F. Kerekes, A. Marston, R. A. Moyer.

RIDGE, SYLVESTER EDWIN, Jun., Highland, N.Y. (Elected Nov. 23, 1931.) (Age 29.) Dist. Engr. and Supt., New York State Dist., Bituminous Service Co., West Chester, Pa. Refers to H. E. Breed, W. J. Carroll, C. A. Gridley, W. H. Pearson, R. Radbill.

ROTHSCHILD, ROBERT BARNET, JR., Jun., San Francisco, Calif. (Elected Oct. 14, 1929.) (Age 30.) Engr. and Estimator, MacDonald & Kahn Co., Ltd. Refers to R. L. Allin, C. Derleth, Jr., C. G. Hyde, B. Jameyson, L. H. Nishkian, L. W. Stocker.

SPEERT, JULIUS LOUIS, Jun., Washington, D.C. (Elected Oct. 10, 1927.) (Age 32.) Asst. Hydr. Engr., U. S. Geological Survey. Refers to C. H. Birdseye, R. W. Davenport, N. C. Grover, E. L. Hain, H. Johnson, J. G. Staack, R. M. Wilson.

TIPPETT, DAVID GIBB, Jun., Cape Town, South Africa. (Elected March 5, 1928.) (Age 32.) Res. Engr., Southern Rhodesia Govt., in charge of Umshandige Irrigation Project. Refers to M. B. Case, A. Gibb, N. Shand. (Applies in accordance with Sec. 1, Art. I, of the By-Laws.)

WOODRING, PHILIP WENDELL, Jun., Harrisburg, Pa. (Elected Oct. 14, 1929.) (Age 30.) Jun. Materials Engr., Pennsylvania Dept. of Highways. Refers to W. J. Carroll, H. S. Mattimore, H. H. Miller, T. Pealer, G. A. Rahn, Jr.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1937 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

CONSTRUCTION

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; 35; married; B.S.C.E., Tufts College; 8½ years experience general construction, hydraulic-fill, concrete, and earth-fill dams; tunnels, bridges, and roads. Chief of survey party and office engineering; 1 year with E.C.W. in charge of design and construction of small dams. Location immaterial; available at once. Excellent references. C-258.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; Cornell University, 1934. Desires position with construction or design firm. Location immaterial. Has had 2 years construction and survey experience on sewer and highway jobs, and 1 year on structural steel and concrete design in consulting engineer's office. Just completing job. C-263.

CONSTRUCTION ENGINEER; Jun. Am. Soc. C.E.; Cornell University, 1934, C.E. degree; single; 4 years experience with state, consulting engineers, and private contractors on supervision of construction, design, and appraisal. Experience covers concrete, steel, masonry, frame structures, roads, earthwork, sewage disposal, water supply, and utility appraisal. Employed but interested in proposition requiring young man seeking personal interest in construction business. C-268.

CONSTRUCTION ENGINEER; M. Am. Soc. C.E.; 46; married; 18 years experience in construction and design of dams and other heavy construction. Available February 1. Location immaterial. C-269-6-A-45 San Francisco.

CONSTRUCTION ENGINEER AND SUPERINTENDENT; M. Am. Soc. C.E.; 30 years experience in responsible charge of highway construction, lock and dam and heavy mill construction; cofferdams and dredging; planning, reports, investigation, and design. Would prefer work in Georgia or Alabama. Available at once for whole or part-time work. C-285.

DESIGN

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; married; B.S.C.E.; 3½ years responsible structural designing and detailing, including rigid-frame, arch, and viaduct bridges, concrete pier, heating plant, buildings, and foundations; 1½ years triangulation and topographical survey; 6 months teaching. Available immediately. New York or vicinity preferred. C-264.

EXECUTIVE

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; graduate; licensed in two states. Has practiced under own name with varied experience. At present assistant resident engineer in responsible charge of field operations on two-million-dollar project, stone, concrete, and steel construction. Considerable organizing ability; young; energetic. Available in two weeks. C-260.

CIVIL ENGINEER, DESIGNER, CONCRETE AND STEEL; Jun. Am. Soc. C.E.; 33; married; B.A. in mathematics and B.S. in C.E., University of Michigan. Nearly 6 years experience, office and field work on bridges, buildings, highways, dams, and foundations. Experience in conducting work and handling men. Desires permanent connection. New York City preferred. C-261.

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; B.S. degree and one-year course in civil engineering school; licensed professional civil engineer, New York; 25 years experience in water-supply engineering with consultants, largely as resident engineer on construction, and also on surveys and investigations in field and office. C-267.

SANITARY ENGINEER; Assoc. M. Am. Soc C.E.; graduate; licensed; married; age 36; 14 years experience in sewage-treatment plant design as draftsman, detailer, designer, and supervisor of contract plants for municipality. Employed but available on short notice. C-271.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 30; B.S.C.E.; married; 8 years varied experience; 4 years as project superintendent of earth dams, roads, small buildings, revetment dikes. Administrative experience and qualified as safety engineer. Desires permanent connection in safety or office work. Now employed; available on short notice. Location immaterial. C-272.

CIVIL-STRUCTURAL ENGINEER; Assoc. M. Am. Soc. C.E.; B.S.C.E., Armour Institute of Technology; professional license; 20 years experience. Seeking responsible permanent connection in planning, design, or construction of sewage-disposal or water-purification plants, public or private buildings, factories, bridges. Excellent references. Present location Middle West. C-279.

ENGINEER; M. Am. Soc. C.E.; seeks engagement with industrial or commercial company erecting own plants throughout country, as manager of construction from design to occupancy. Over 25 years experience in building construction, including 17 years management of general building-contracting business with record of economical and satisfactory completions. C-281.

JUNIOR

ENGINEER; Jun. Am. Soc. C.E.; 32; married; C.E., Rensselaer Polytechnic Institute, 1928; 9 years experience in engineering department of large oil refinery; 3 years field engineering, estimating, construction, and cost-control work; 6 years testing materials and equipment; fair knowledge of Spanish; desires more responsible position with greater opportunities. C-259.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; age 27; married; B.S.C.E., Drexel Institute of Technology; 4 years experience in oil refinery—operation and maintenance; 2 years highway drafting and general surveying. Desires position in any branch of civil engineering with opportunity for advancement. Available immediately. Location unimportant. C-262.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 22; B.S.C.E., Massachusetts Institute of Technology, 1937; 6 months experience on highway construction as assistant superintendent and timekeeper. Desires permanent position in engineering construction, not necessarily in line with past work. Location immaterial; available immediately C-270.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; B.S.E., University of Michigan, 1937. Desires any kind of work of engineering nature, office or field; location unimportant; 9 months experience with railroad labor. Single; 22; excellent health and fit for hard work. Available on short notice. C-276.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; B.S.C.E., with honors, 1936; Sigma Tau; 1¾ years experience with government as rodman, instrumentman, map draftsman on dams, irrigation gardens. Will accept work in any branch of civil engineering. Interested in structures; surveying, design, and construction of dams and irrigation projects. Available immediately. C-277-9326 Chicago.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 23; single; B.S.C.E., Drexel Institute of Technology; Tau Beta Pi; 1 year hydraulic studies for flood control; 1 year inspection and surveying on large excavation project; 5 months drafting; 6 months hydrographic surveying. Desires position with future, preferably in the East. Available on short notice. C-265.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; married; B.S.C.E., 1934; 7 months experiment-station surveys; 2 months plane-table topographic surveys; 16 months engineering aide, U. S. Department of Agriculture; 14 months junior engineer, U. S. Department of the Interior; now employed. Desires responsible position with chance for advancement. Salary secondary. Available two weeks notice. Location immaterial. C-273-381-A-2-San Francisco.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., Washington University (St. Louis); 1 year graduate work in concrete and timber testing; 1 year general surveying; 3 years as assistant civil engineer, large water-pipe construction. Desires position with future. Work and place immaterial if qualified. Available two weeks notice. C-275-9329 Chicago.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; B.S.C.E., University of Iowa. Majored in sanitary and structural engineering; married; 3½ years experience, chemical plant engineering. Good knowledge of equipment and materials used for various chemicals. Location immaterial. Available immediately. Desires connection with industrial plant or in sanitary field. C-278.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 28; married; A.B.B.S., Columbia University. Experience consists of building construction and estimating, surveying, costs and progress reports; contractor's engineer and superintendent on road, bridge, sewer, and water-works projects. Design timber falsework for rigid-frame reinforced concrete bridge. Desires position with consultant or contractor. C-280.

CIVIL ENGINEER; young; graduate of New York college; 2 years experience in foundation work, construction, and drafting. Will accept an opening in any location. C-282.